Promoting the advantages of sustainable and healthy eating using food demonstration kiosks and webpage interventions

Claire Chartrand

School of Dietetics and Human Nutrition

McGill University

Montreal, Quebec

Submitted May 2013

A project report submitted to McGill University in partial fulfillment of the requirements of the degree of M.Sc. (Applied) Nutrition.

Table of Contents

Preamble

The main goal of my Masters (Applied) Research Project was to educate McGill students about the environmental and health benefits of sustainable eating in order to increase their participation in sustainable eating behaviors such as eating local, cooking at home, and eating meatless meals. My role in this project was to work in collaboration with Fit@McGill and with dietetic stagieres to prepare intervention materials consisting of a webpage, videos, printed materials and posters, recipe cards, and food demonstrations. I used the Theory of Planned Behavior to design the intervention content and evaluate behavior change. The intervention materials were intended to improve students' attitudes and knowledge concerning sustainable eating, improve their perceived behavioral control (self efficacy) to take part in sustainable eating behaviors, and provide social influences that encourage them to eat sustainably. McGill students could access these materials on the Fit@McGill Webpage, and weekly McGill Farmers' Market Kiosks during the months of September and October in the Fall 2012 semester.

For the evaluation process, my main objective was determine if the intervention was effective in improving students' behavioral intentions to eat locally, cook at home, and eat meatless meals, and also to determine which intervention (webpage or kiosk) was most efficacious in doing so. A secondary objective was to increase students' fruit and vegetable intake as a result of eating more sustainable.

Before beginning the study, research ethics board approval was obtained by the Faculty of Environmental and Agricultural Sciences. The Mary H. Brown Fund and Sustainable Projects Fund provided funding for the project. Baseline data was collected during September and October from students who visited the sustainable eating website using Limesurvey, or from

paper surveys completed by students who visited the kiosk at the McGill Farmers' Market. Data was analyzed from December through to February using the software SPSS 20. Descriptive statistics were used to analyze the demographic profile of the participants. Wilcoxin signed rank tests were used to analyze the difference in fruit and vegetable intake, attitude (ATT), perceived behavioral control (PBC), social norms (SN), and intention scores. Partial correlations were performed to assess association between intention and ATT, PBC, and SN.

The timeline for this project ran from April 2012 until April 2013. Following the final analysis, I prepared a report according to the Environmental Health Perspectives journal guidelines, outlining the background literature, study objectives, methods, results, discussion and conclusion to prepare for eventual submission to the journal.

Abstract

Background: Previous research has found that university students lack knowledge about the importance of sustainable eating, and frequently rely on processed and packaged non-sustainable foods as a source of nutrition. Nutrition interventions promoting sustainable eating in university students offer an opportunity to improve their dietary quality while providing environmental benefits.
Objectives: (1) To increase students intentions to eat local foods, cook at home, and eat meatless meals using two interventions: a webpage, and informational kiosk; (2) To compare the efficacy of each intervention to improve sustainable eating behavioral intentions; (3) To improve fruit and vegetable intake as a secondary outcome to eating more sustainable.
Methods: All participants (n=49) completed baseline and follow-up questionnaires assessing their fruit and vegetable intake, attitudes (ATT), perceived behavioral control (PBC), social norms (SN), and behavioral intentions towards sustainable eating. Wilcoxin signed rank tests were performed to determine changes overtime for variables. Partial correlation tests were performed to assess associations between variables.
Results: There was a significant increase in ATT scores towards eating more sustainable. However, intention, PBC, and SN scores, and fruit and vegetable intake did not change overtime. Behavioral intentions were correlated with PBC and ATT scores.
Conclusion: Educational kiosks and webpage community nutrition interventions can be used to improve university students' attitudes concerning sustainable eating. However, increasing PBC may be essential to actually improve behavioral intentions to eat sustainably.

Key words: Nutrition interventions, sustainable eating, university students, dietary habits, Theory of Planned Behavior, webpage, videos, farmers' market

Introduction

Over the past half century, the global population has risen to 6 billion and it is predicted to reach 9 billion by the year 2050 (Defra 2009). As the population continues to increase, there will also be an increasing demand on the earth to provide natural resources and food, and therefore it is essential that we find ways to produce and consume food sustainably (Defra 2009; Lappe 2010). Sustainable eating means to choose foods that are good for human health and produced using sustainable agriculture methods that do not harm the environment (Herrin M and Gussow JD 1989). Educating students (ages 18-25) about sustainable eating is important for four main reasons. First, past studies evaluating students' attitudes and understanding about sustainable eating have found that they display a level of confusion surrounding the term "sustainable eating" and many of them are unaware of steps they can take to make their diets sustainable (Pearson D et al. 2010). Second, many students do not consider sustainable eating important, and display low intentions to purchase sustainable foods (Bissonnette M and Contento I 2001; Robinson R and Smith C 2002). Third, eating a sustainable diet can assist in improving dietary quality. Currently, the dietary habits of many students are poor and they report high reliance on fast food, and processed and packaged convenient foods as a source of nutrition, leading to low intakes of fruit and vegetables, and high intakes of fat, sugar, and salt (Engler-Stringer R 2009; Larson et al. 2011). Pelletier found that students who report sustainable eating as important have associated healthier dietary patterns, including higher intakes of fruit and vegetables, and more frequent consumption of breakfast (Pelletier et al. 2013). Lastly, university students are beginning to develop their own personal beliefs and values, becoming more independent, and more responsible for their food choices (Cox DN et al. 1998; Demnison and

Shepherd 1995). Therefore, it is important to help students establish healthy and sustainable dietary habits at a young age so they can be carried on into adulthood.

Purchasing local foods, cooking at home, and eating less meat are three simple sustainable eating behaviors that offer both environmental and health benefits. Purchasing local foods can help reduce the use of fuel and carbon dioxide emissions that occur during the transportation of food (Natural Resource Defence Council 2007; Pirog and Rich 2001). Previous research has also found that increasing community access to local farmers' markets has been associated with increased fruit and vegetable intake and decreased prevalence of obesity within communities (Evans et al. 2012; Jilcott S et al. 2011; Rundle A et al. 2009). Cooking more meals at home using whole natural foods results in a decreased reliance on processed and packaged foods as a source of nutrition that require large inputs from natural resources during production and contribute to packaging waste (Chenhall 2011). Previous research has found that university students who participated less in traditional meal preparation, had greater consumption of meals from restaurants, greater consumption of processed, packaged and convenient foods, and an increased prevalence of obesity (Engler-Stringer R 2009; Larson et al. 2011); while students who reported adequate food preparation skills had associated reductions in fast food consumption (Larson NI et al. 2006). Alternative protein sources such as beans, legumes, and lentils require much smaller inputs of energy, water, and land/soil for their production when compared to the production cycle of meat products (Pimentel D et al. 1997; Pimentel D and Kounang N 1998; Pimentel D and Pimentel M 2003). The American Dietetic Association states that well balanced vegetarian meals tend to be lower in saturated fat and cholesterol and higher in fiber and essential nutrients resulting in lower levels of blood cholesterol and blood pressure, decreased risk of heart disease, diabetes, and stroke, and decreased risk of all forms of cancer (American

Dietetic Association 2009). By using interventions to educate university students about sustainable eating, we can help improve their dietary quality and maintain environmental health.

One of the main challenges in educating students using public health interventions is determining how to successfully communicate facts and skills ways they find valuable. Television and videos, and computers and the Internet may provide an effective communication channel to deliver nutrition information because they are used in the daily activities of many students. Previous studies by Silk et al (2008), Nichols and Schmidt (1995), and Hanss and Bohm (2013) have found that informational webpages and video messages were effective at increasing general nutrition knowledge, knowledge about sustainable eating, and consumer intentions to purchase sustainable foods. These channels were also rated highly for user "liking" and "intention to use" (Hanss and Bohm 2013; Nichols L and Schmidt M 1995; Silk KJ et al. 2008). Printed brochures, the provision of recipe cards, and the use of cooking classes have also been effective in improving nutrition knowledge and dietary behaviors (Levy J and Auld G 2004; Silk KJ et al. 2008). In a study by Eastman and Greene (2012) to increase sustainable eating behaviors in university students, students suggested that interactive interventions, the use of videos, and the provision of recipes would be the most effective way to relay nutrition information to this age group (Eastman and Greene 2012).

Due to the poor knowledge and attitudes concerning sustainable eating, and poor dietary habits displayed by students in previous research, this study was designed to educate students about sustainable eating and promote their participation in healthful and sustainable eating practices through the use of web based resources and educational kiosks and food demonstrations at the McGill's Farmers' Market. For the purpose of this study, sustainable eating encompasses purchasing and eating locally grown foods, reducing meat intake, and

cooking at home. Objectives of this study include: (1) to increase students' intention to eat locally, cook meals at home, and eat more meatless meals through the use of an educational webpage with video messages, and a farmers' market kiosk with food demonstrations; (2) to compare the efficacy of these interventions to see which is more successful in improving sustainable eating intentions; (3) to increase students' fruit and vegetable intake as a secondary outcome to eating more sustainable. We predicted that both interventions would increase students' intentions to eat sustainably, and as a secondary outcome we would observe an increase in fruit and vegetable intake.

Methods

Behavior Change Theory

The Theory of Planned Behavior (TPB) was used to construct content for the interventions and to evaluate behavior change. This model is used to predict one's behavioral intentions to perform a specific behavior and assumes the higher one's intentions are to perform a specific behavior, the higher their motivation is to do so, resulting in them performing the behavior more often. Behavioral intention is predicted by three different behavioral constructs: attitudes, perceived behavioral control, and subjective norms (Ajzen 1991). Attitude (ATT) refers to one's overall evaluation of the behavior; perceived behavioral control (PBC) is similar to self-efficacy and refers to how capable one feels they are at successfully performing a behavior (Kellar I and Abraham C 2005); and subjective norms (SN) refer to one's beliefs about how significant others (family, friends, peers, etc.) think they should behave (Ajzen 1991). In accordance with the TPB, if a student believes eating sustainably is better for their health and the environment, they are confident in their ability to purchase and prepare sustainable foods, and

they perceive social pressure from those around them to eat sustainably, then their intentions to do so will increase and ultimately their dietary behaviors will be sustainable. Previous studies on sustainable eating found that the TPB has accounted for 30.9% and 50.1% of the variance in intentions to eat local foods (Bissonnette M and Contento I 2001; Vermeira I and Verbekeb W 2008).

Intervention

The intervention took place during the fall semester at the downtown campus of McGill University and consisted of two components: an informative webpage on sustainable eating, and a weekly educational sustainable eating kiosk at the downtown campus' McGill Farmers' Market. Both interventions were designed to modify students' ATT, PBC, and SN in order to increase their intentions to eat local foods, cook at home, and eat less meat. The webpage was termed "Sustainable Eating" and linked through the Fit@McGill website, an online resource run by McGill Health Promotion that encourages students to eat well and keep active. To address ATT, the webpage provided information about why sustainable eating is important through print, videos, and links to other informational webpages. To address PBC, the webpage provided video tips about how to eat sustainably, information about the locations where students can purchase sustainable foods on and off campus, and a list of recipes for students to try at home. To address SN, the webpage used university students in the sustainable eating videos as a form of peer education. The educational kiosks were held weekly at the McGill Farmers' Market for nine weeks, from August through October, and all students passing by were welcome to visit the kiosks. To address ATT, the kiosks provided informational materials about the importance of eating sustainably and its consequences on a poster and take home recipe cards. To address PBC, the kiosks provided students with steps on how to eat sustainably, recipes for students to try at

home, and students were able to view cooking demonstrations and taste food samples. To address SN, the kiosks were hosted by dietetic stagieres as a form of peer education and located centrally on the McGill campus.

Data Collection

The study received approval from the Ethics Review Board within the Faculty of Agricultural and Environmental Sciences at McGill University. Data collection ran from the end of August 2012 until the end of November 2012, for a total of 12 weeks. All students were welcome to participate in the study. The baseline survey could be completed by students who approached the kiosk at the McGill Farmers' Market during any of the nine weeks, or online through the homepage of the Sustainable Eating website. Participants provided informed consent when completing the baseline survey, allowing researchers to contact them with the follow-up survey that was emailed 12 weeks after the intervention began. During the follow-up survey, participants indicated how many videos they watched and/or how many times they attended the farmers' market kiosk. Based on reported intervention exposure, participants were divided into 1 of 3 study groups: Market Group, Webpage Group, or Market+Webpage Group. As an incentive to complete the study, participants were entered into a draw to win a cooking at home kit, a fifty-dollar gift certificate from the McGill bookstore, or a free winter gym membership at the McGill fitness center.

Measures

During the baseline survey, demographic questions and other related measures were completed. These included gender, age, body weight and height, level of study, and faculty. Participants indicated their daily fruit and vegetable intake with response options ranging from 1 serving to ≥ 8 servings per day. Examples of 1 serving size were included for participant

reference. Participants were also asked whether or not they consume poultry, meat, or fish. Additional questions on the follow-up survey asked participants about how many farmers' market kiosks they attended and the number of online videos they watched.

Behavioral constructs from the TPB were measured individually for each behavior: eating local, cooking at home, and eating meatless meals. Questions on the survey were derived from a previous study on sustainable eating which designed questions based on the TPB (McDonough T 2012). The same questions were used to measure ATT, SN, PBC and behavioral intentions for the baseline and follow-up surveys. Behavioral construct questions were measured using a 5-point likert scale where 1=strongly disagree, 2=somewhat disagree, 3=neutral, 4=somewhat agree, and 5=strongly agree. To prevent students from selecting similar answers without reading each question, some questions were positively worded while others were negatively worded and then recoded for data analysis.

Attitude was assessed with 3-4 items concerning health, environmental benefits, convenience, cost, and availability for each sustainable eating behavior. Attitude scores were calculated for each participant using two scales and the following equation: $ATT = \sum a_i b_i$, where a_i is the outcome evaluation score, and b_i is the behavioral belief score. Items assessing outcome evaluation referred to how important a behavior is to an individual (Ex: "It is important to me to eat food that is healthy"). Responses to these items were translated into scores ranging from -2 to +2. Items assessing behavioral beliefs referred to an individual's belief about the consequences of performing a specific behavior (Ex: "By preparing my own meals at home, I am eating food that is healthier"). Responses to these items were translated into scores ranging from 1 to 5. To calculate the overall attitude score for each participant, their scores for each outcome evaluation were multiplied with their scores for each corresponding behavioral belief, and these values were

summed to form a composite attitude score. Subjective norms and perceived behavioral control were each measured using two items, with responses measured on 5-point likert scales. For subjective norms, participants reported their agreement for the following: "I feel under social pressure from my family and those around me to…" and "My friends choose/cook/eat… as often as possible" for each of the three sustainable behaviors. For perceived behavioral control, participants reported their agreement for the following two items: "If I wanted to, it would be possible for me to…" and "I am confident I can …" for each of the three sustainable behaviors. Responses to each of these items were translated into scores ranging from 1 to 5. The SN and PBC score for each participant was calculated by taking the average score from of the two items. Behavioral intention was measured using an individual item for each of the three sustainable behaviors.

Data Analysis

Data was analyzed using IBM® SPSS® Statistics 18.0.0. Participants were divided into three intervention groups. Group 1 (n=16) consisted of those who only visited the Sustainable Eating Kiosk at the McGill Farmers Market, Group 2 (n=19) consisted of those who only looked at the sustainable eating webpage, and Group 3 (n=14) consisted of participants who visited the sustainable eating kiosks and viewed the sustainable eating webpage. Data was analyzed according to intervention groups and also as a combined group (n=49). Descriptive statistics were used to analyze the demographic profile of the study group. Exploratory tests found that data regarding serving intake of fruit and vegetables, and scores for ATT, SN, PBC, and intention were not normally distributed and therefore non-parametric tests were used for data analysis. Two-tailed Wilcoxin Signed Rank tests were used to evaluate differences in self-reported fruit and vegetable intake, and mean scores for ATT, SN, PBC, and behavioral

intentions. Partial correlation tests were used to explore the associations between intentions and ATT, SN, and PBC for each behavior.

Results

Description of Participants

Demographic characteristics of participants according to the total combined group and intervention groups can be seen in **Table 1**. All study groups were comparable at baseline. When looking at the study group as a whole, a large proportion (79%) of participants were female. The average age of participants was 21.8 years old. The mean BMI of the study group was 21.5kg/m^2 and 80% of participants had a BMI within the recommended range of 18.5-24.9 kg/m^2. The majority of participants were not vegetarian.

Fruit and vegetable intake

Results for fruit and vegetable intake according to intervention groups and the total combined group can be found in **Table 2**. At baseline the largest proportion of students (49%) were consuming 4-5 servings per day, and only 10% of participants had a daily intake of 7 or more servings of fruit and vegetables. The average daily intake was 4.6 servings per day during survey 1, and 4.4 servings per day during survey 2. There was not a significant difference in fruit and vegetable intake overtime for any of the intervention groups, or the combined study group ($p=0.305$).

Eating Locally

Results for behavioral construct scores for eating locally, cooking at home, and meatless meals from Survey 1 and Survey 2 can be found in **Table 3**. There was no significant difference

in construct scores of ATT, PBC, SN, and behavioral intentions overtime for any of the intervention groups for Eating Local. When looking at the combined study group (n=49), there was a significant increase in ATT to eat locally (p=0.046). Analysis of individual items assessing attitudes that made the composite attitude score can be seen in **Table 4**. For local eating, there was an improvement in attitude scores concerning the cost benefits of eating local foods (p=0.028). There was no significant difference in intention to eat locally overtime within the intervention groups or the total combined study group. Partial correlations found that behavioral intention to eat locally was significantly correlated with PBC (p=0.005) during survey 1, and PBC (p=0.002) during survey 2 (**Table 5**).

Cooking at Home

The Webpage intervention group had a significant increase in PBC scores (p=0.011) **(Table 3)**. ATT and SN scores did not change overtime in any of the intervention groups. Within the total combined study group there was a significant increase in mean ATT scores (p=0.05). Analysis of individual items assessing attitudes found that attitudes in regards to health benefits of cooking at home improved overtime (p=0.041) **(Table 4)**. There was not a significant difference in intention to cook at home for the three intervention groups or the total combined study group. Partial correlation tests found that intention to cook at home was significantly correlated with ATT (p<0.001) and PBC (p<0.001) during survey 1, and ATT (p=0.008) and PBC (p<0.001) during survey 2 **(Table 5)**.

Meatless Meals

Although were no significant differences in behavioral construct scores of ATT, PBC, and SN overtime for any of the intervention groups for eating meatless meals, an evaluation of the combined study group (n=49) demonstrated a significant increase in ATT scores towards eating

meatless meals (p=0.0007) **(Table 3)**. Analysis of individual items assessing attitudes found that attitudes in regards to health benefits of eating meatless meals increased between surveys (p=0.020), and attitudes in regards to the cost benefits of eating meatless meals significantly increased between surveys (p=0.042) **(Table 4)**. There was no significant difference overtime in intentions to eat meatless meals in any of the intervention groups or the total combined study group. Partial correlation tests found that intention to eat meatless meals was significantly correlated with ATT (p=0.003) and PBC (p=0.003) during survey 1, and ATT (p=0.048) during survey 2 **(Table 5)**.

Discussion

This study used an intervention consisting of an informational webpage and sustainable eating kiosks with food demonstrations to increase university students' intentions to eat locally, cook at home, and eat meatless meals; and increase their fruit and vegetable intake. Results from this study found that the intervention was not successful in significantly improving the behavioral intentions of university students to participate in sustainable dietary behaviors, or increase fruit and vegetable intake. Although the effect of the three intervention groups on behavioral construct scores was minimal, when participants from each intervention were combined into one group (n=49) and re-evaluated, results found a significant improvement of attitude scores within all three sustainable behaviors. The inability to detect a change in ATT scores in the individual intervention groups was likely due to small sample sizes. Results from this study indicate that while the interventions were successful at improving students' attitudes in regards to sustainable eating, this improvement in one behavioral construct was unable to significantly influence behavioral intention to eat more sustainable.

Findings demonstrated that the daily intake of fruit and vegetables was below recommendations, which was consistent with other studies in university students (McDonough T 2012; Pelletier et al. 2013; Richards A et al. 2006). Women should be consuming 7 or more servings of fruit and vegetables per day and men should be consuming 8 or more (Health Canada 2008). Within this group of students, 0% of males and only 10.2% of females were meeting their recommended intake. Daily intakes may not have increased for several reasons. First, students' intentions to eat sustainably did not increase, indicating that students were likely still consuming the same amount of meat, dining out, and consuming processed foods as they were at baseline. Second, students have a tendency to fluctuate in their fruit and vegetable intake due to changing circumstances (moving off campus, time of the semester, etc.) (Richards A et al. 2006). In this study, students completed the follow-up survey at the end of the semester when nutrition may not be a priority because of upcoming exams when stress levels are likely high. Mikolajczyk et al (2009) found associations between high consumption of sweets (chocolate, cake, biscuits, sweets) and high stress levels in university students (Mikolajczyk RT et al. 2009). Third, the primary objectives of this study were to increase sustainable eating patterns of students, and therefore messages provided throughout the intervention were mainly focused on eating local, cooking at home, and eating meatless meals and did not directly address increasing fruit and vegetable intake (Ciliska D et al 1999).

The intervention was most successful at improving participants' attitudes towards eating local, cooking at home, and eating meatless. This intervention was very information based and provided participants with an abundance of information about the environmental and health consequences of eating sustainably. This may have increased participants' knowledge on the subject, accounting for their changes in attitude (Steg L and Vlek C 2009). Comparable results in

a study by Hanss and Bohm (2013) using an online informational intervention to increase consumers' intentions to purchase sustainable foods found that although the self-efficacy scores of consumers did not significantly increase, consumers stated that they learned a lot from the intervention, became more conscious of their own sustainable behaviors, and thought more about the environment (Hanss and Bohm 2013). In the present intervention, attitudes concerning health and cost benefits of eating sustainable both improved. This likely occurred because the main intervention messages were primarily based on environment, health, and cost benefits of each sustainable behavior. Previous studies have found that cost and health are strong influencing factors of food choice (Driskell JA et al. 2006; Lappalainen R et al. 1998), and therefore, students may have been more attentive to messages concerning cost and health benefits of sustainable eating in this intervention.

The Webpage group was the only intervention group that had a significant increase in PBC scores for cooking at home. This may be due to a Type 1 error because the videos for 'eating local' and 'meatless meals' were relatively similar to the one for 'cooking at home', yet there was not an increase in PBC scores for either of these behaviors within the webpage intervention group. However, this increase in PBC scores may also be because the Webpage intervention provided a large variety of simple and affordable sustainable recipes for students to try and cook at home, and offered links to the Fit@McGill Eat Well webpage, which offers more information about how to grocery shop, pack a lunch, and Canada's Food Guide to healthy eating.

Overall, the intervention was not successful at increasing PBC scores in all three sustainable behaviors. Comparable results were found in a similar intervention that was primarily information focused, and had no interactive component for participants (Hanss and Bohm 2013).

Incorporating a hands-on component, and allowing participants to practice sustainable eating behaviors may have been required to increase PBC scores. For example, although food demonstrations are more effective at reaching large audiences, offering hands on cooking classes has been more effective than food demonstrations in increasing students' confidence and skills to cook at home (Levy J and Auld G 2004; McDonough T 2012).

Social norm scores were not significantly increased throughout the intervention. The use of dietetic stagieres at the farmers' market intended to be the most influential on social norms, however it is important to remember that other social influences from family and friends are very influential on dietary choices (Feunekes G et al. 1998). Participants in the webpage group also did not have direct social contact with the dietetic stagieres.

Intentions to eat sustainably did not increase overtime even though there was an increase in attitudes. This is referred to as the attitude-behavioral intention gap and it suggests there are other factors that influence behavioral intentions (Vermeir I and Verbeke W 2006). Possible explanations for the absence in improvement of intention scores include the difficulty in changing long-term dietary habits, other situational factors such as sales on non-sustainable food items, and poor perceived behavioral control in participants to perform the behavior (Jager W 2000; Minteer BA et al. 2004). In the present study, results from partial correlation tests indicated that ATT and PBC were most highly correlated with intention to perform a behavior. Comparable results were found in other studies using the TPB (Bissonnette M and Contento I 2001; Vermeira I and Verbekeb W 2008). This means that an increase in ATT and PBC will likely be associated with an increase in intentions to perform a specific behavior. Therefore, even if students' ATT scores increased, yet their PBC has not, then an increase in intentions to eat sustainably may not be possible. Another explanation for the absence of improvement in

behavioral intentions scores may be due to possible self-selection bias. Students who approach the farmers' market kiosks and search the Fit@McGill website might already be interested in the topic of nutrition of sustainable eating, and already intend to eat healthy and sustainably as often as possible.

There are several limitations within this study. First, due to small sample sizes and non-parametric data, a mixed model ANOVA could not be used to measure the effect of intervention group and time on behavioral constructs for the sustainable eating. The small sample size may have also altered interpretation of the results as changes in behavioral construct and intention scores may have been found significant if the sample size was larger. Second, because this intervention was carried out in a realistic community setting, we were unable to control how much attention participants paid to the intervention and there was likely a large amount of variability existing in how much each participant was actually exposed and to the intervention material. Third, participants were mostly female and this is not representative of large populations. Fourth, the survey measured behavioral intentions and not the actual frequency students participate in each of the sustainable eating behaviors.

In order to more effectively evaluate the use of webpages, video messages, and farmers' market kiosks to increase sustainable eating behaviors, future research needs to use larger sample sizes to yield more reliable results. Using a controlled study design will help draw more accurate conclusions about the efficacy of informational webpages, videos, and kiosks to increase sustainable dietary habits. However, a more controlled study design may not represent how people will realistically use public health materials in non-intervention settings. Although this intervention was effective at increasing ATT, it is important that researchers find ways to increase PBC to help improve behavioral intentions. Suggestions for future studies include

developing more interactive components such as cooking classes, and organized trips to the farmers' market or grocery stores for shopping lessons. It is important to remember that consumers are not a homogenous group and their awareness of environmental issues, values, and skills may vary between individuals (Vermeir I and Verbeke W 2006). A general intervention such as the one used in this study may not be as effective as interventions that are tailored to individual consumer segments to improve heath related behaviors (Rimer BK and Kreuter MW 2006). Using the Internet to design more tailored interventions provides a possibility to reach larges audiences while providing custom made information (Abrahamse W et al. 2007).

Conclusion

This study demonstrates the use of farmers' market kiosks with print materials and an informational webpage with video messages can be implemented into community nutrition interventions to increase university students' attitudes towards sustainable eating. While this type of intervention is successful in increasing attitudes, it is important that methods to increase PBC are researched and incorporated into these interventions in order to increase intentions and behaviors to eat sustainably.

References

Abrahamse W, Steg L, Vlek C, Rothengatter T. 2007. The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents. Jounral of Environmental Psychology 27:265-276.

Ajzen I. 1991. The theory of planned behavior. Organization Behaviour and Human Decision Processes 50:179-211.

American Dietetic Association. 2009. Position of the american dietetic association: Vegetarian diets. Journal of the American Dietetic Association 109:1266-1282.

Bissonnette M, Contento I. 2001. Adolescents' perspectives and food choice behaviors in terms of the environmental impacts of food production practices: Application of a psychosocial model. Journal of Nutrition Education 33:72-82.

Brug J, Lechner L, De Vries H. 1995. Psychosocial determinants of fruit and vegetable consumption. Appetite 25:285-296.

Chenhall C. 2011. Impproving cooking and food preparation skills. A synthesis of evidence to inform program and policy development.

Ciliska D et al. 1999. The effectiveness of community interventions to increase fruit and vegetable consumption in people four years of age and older. Effective public health practice project.

Cox DN, Anderson AS, Reynolds J, McKellar S, Lean M, Mela DJ. 1998. Take five, a nutrition education intervention to increase fruit and vegetable intakes: Impact on consumer choice and nutrient intakes. British Journal of Nutrition 80:123-131.

Defra. 2009. Department of environment, food and rural affairs: First report from the council of food policy advisers. Sept 2009. Available: http://www.defra.gov.uk/foodfarm/food/policy/council/pdf/.

Demnison CM, Shepherd R. 1995. Adolescent food choice: An application of the theory of planned behaviour. Journal of human Nutrition and Dietetics 8:9-23.

Driskell JA, Meckna BR, Scales NE. 2006. Differences exist in the eating habits of university men and women at fast-food restaurants. Nutrition Research 26:524-530.

Eastman K, Greene G. 2012. The “green eating” project: A pilot intervention to promote sustainable and healthy eating in college students:University of Rhode Island.

Engler-Stringer R. 2009. The domestic foodscapes of young low-income women in montreal: Cooking practices in the context of an increasingly processed food supply. Health Education and Behaviour 37:211-226.

Evans A, Jennings R, Smiley A, Medina J, Sharma S, Rutledge R, et al. 2012. Introduction of farm stands in low-income communities increases fruit and vegetable among community residents. Health and Place 18:1137-1143.

Feunekes G, De Graaf C, Meyboom S, Van Staveren W. 1998. Food choice and fat intake of adolescents and adults: Associations of intakes within social networks. Preventitive Medicine 27:645-656.

Hanss D, Bohm G. 2013. Promoting purchases of sustainable groceries: An intervention study. Journal of Environmental Psychology 33:53-67.

Health Canada. 2008. How many food guide servings of vegetables and fruit do i need>. Available: http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/choose-choix/fruit/need-besoin-eng.php.

Herrin M, Gussow JD. 1989. Designing a sustainable regional diet. Journal of Nutrition Education and Behaviour 21:270-275.
Jager W. 2000. Modelling consumer behavior [PhD thesis]. Groningen:University of Groningen.
Jilcott S, Keysrling T, Crawford T, McGuirt J, Ammerman A. 2011. Examining associations among obesity and per capita farmers' markets, grocery stores/supermarkets, and supercenters in us counties. Journal of American Dietetic Association 111:567-572.
Kellar I, Abraham C. 2005. Randomized controlled trial of a brief research-based intervention promoting fruit and vegetable consumption. British Journal of Psychiatry 10:543-558.
Lappalainen R, Kearneyc J, Gibney M. 1998. A pan eu survey of consumer attitudes to food, nutrition and nealth: An overview. Food Quality and Preference 9:467-478.
Lappe A. 2010. Diet for a hot planet. New York:Bloomsbury.
Larson N, Neumark-Sztainer D, Laska M, Story M. 2011. Young adults and eating away from the home: Associations with dietary intake patterns and weight status differ by choice of restaruant. Journal of the American Dietetic Association 111:1696-1703.
Larson NI, Perry CL, Story M, Neumark-Sztainer D. 2006. Food preparation by young adults is associated with better diet quality. Journal of the American Dietetic Association 106:2001-2007.
Levy J, Auld G. 2004. Cooking classes outperform cooking demonstrations for college sophomores. Journal of Nutrition Education 36:197-203.
McDonough T. 2012. Modifying students' intentions to eat sustainably:McGill University.
Mikolajczyk RT, Ansari WE, Maxwell AE. 2009. Food consumption frequency and perceived stress and depressive symptoms among students in three european countries. Nutrition Journal 8:1-8.
Minteer BA, Corley EA, Manning RE. 2004. Environmental ethics beyond principle? The case for a pragmatic contextualism,. ournal of Agricultural and Environmental Ethics 17:131-156.
Natural Resource Defence Council. 2007. Food miles: How far your food travels has serious consrquences for your health and then climate. Washington, DC:NRDC.
Nichols L, Schmidt M. 1995. The impact ofvideo tapes in educating grocery store shoppers about fat and cholesterol. JNE 27:5-10.
Pearson D, Henryks J, Rowe P. 2010. Sustainable consumption in australia: What do generation y consumers know about their food choices? In: Australian and New Zealand Marketing Academy (ANZMAC) Conference. Christchurch New Zealand.
Pelletier J, Laska M, D. N-S, Story M. 2013. Positive attitudes toward organic, local, and sustainable foods are associated with higher dietary quality among young adults. Journal of the Academy of Nutrition and Dietetics 113:127-132.
Pimentel D, Houser J, Preiss E. 1997. Water resources: Agriculture, the environment, and society. Bioscience 47:97-106.
Pimentel D, Kounang N. 1998. Ecology of soil erosion in ecosystems. Ecosystems 1:416-426.
Pimentel D, Pimentel M. 2003. Sustainability of meat-based and plant-based diets and the environment. American Journal of Clinical Nutrition 78:660S-663S.
Pirog, Rich. 2001. Food, fuel, and freeways: An iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions. Leopold Center for Sustainable Agriculture.
Richards A, Kattelmann K, Ren C. 2006. Motivating 18- to 24- year-olds to increase their fruit and vegetable consumption. Jounral of the American Dietetic Association 106:1405-1411.
Rimer BK, Kreuter MW. 2006. Advancing tailored health communication: A persuasion and message effects perspective. Jounral of Communication 56:S184-S201.

Robinson R, Smith C. 2002. Psychosocial and demographic variables associated with consumer intention to purchase sustainably produced foods as defined by the midwest food alliance. Journal of Nutrition Education and Behaviour 34:316-325.
Rundle A, Neckerman KM, Freeman L, Lovasi GS, Purciel M, Quinn J, et al. 2009. Neighborhood food environment and walkability predict obesity in new york city. Environment Health Perspect 117:442-447.
Silk KJ, Sherry J, Winn B, Keesecker N. 2008. Increasing nutrition literacy: Testing the effectiveness of print, web site, and game modalities. Journal of Nutrition Education Behaviour 40:3-10.
Steg L, Vlek C. 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. Journal of Environmental Psychology 29:309-317.
Vermeir I, Verbeke W. 2006. Sustainable food consumption: Exploring the consumer "attitude-behavioral intention" gap. Journal of Agricultural and Environmental Ethics 19:169-194.
Vermeira I , Verbekeb W. 2008. Sustainable food consumption among young adults in belgium: Theory of planned behaviour and the role of confidence and values. Ecological Economics 64:542-553.

Tables

Table 1: Descriptive data of basic demographic characteristics of participants

Demographic Category	Response Variables	Total N = 49 (%)	Market N = 16 (%)	Webpage N = 19 (%)	Market+ Webpage N = 14 (%)
Gender	Female	79.6	81.3	89.5	64.3
	Male	16.3	18.8	10.5	24.1
	No Response	4.1	0	0	14.3
Age	<18	4.1	12.5	0	0
	18-24	73.5	68.7	84.2	64.3
	>25	22.4	18.8	15.8	35.7
BMI	<18.5	4.1	6.3	5.3	0
	18.5-24.9	81.6	87.4	73.7	85.7
	25-29.9	12.2	6.3	21	7.2
	No response	2	0	0	7.2
Faculty	Agricultural and Environmental Sciences	12.2	12.5	15.8	7.1
	Arts	32.7	31.3	31.6	35.7
	Education	4.1	6.3	0	7.1
	Engineering	8.2	0	15.8	7.1
	Management	6.1	6.3	5.3	7.1
	Science	16.3	12.6	10.5	28.6
	Other	22.5	31.3	21.1	7.1
Vegetarian	Yes	93.9	100.0	89.5	92.8
	No	6.1	0	10.5	7.3
Vegetable and Fruit Intake	< 7 servings per day	90	87.3	94.8	85.7
	≥ 7 servings per day	10	12.5	5.2	14.3
Number of videos viewed	Viewed ≥ 3 videos	40	N/A	47	78
	Viewed < 3 videos	6	N/A	53	22
Number of kiosks attended	1-3	51	94	N/A	71
	4-6	6	6	N/A	14
	7-9	4	0	N/A	14

Table 2: Differences in vegetable and fruit intake between time 1 and time 2

Group	Time 1		Time 2		P value
	Mean	SD	Mean	SD	
Market (N=16)	4.63	1.78	4.06	1.34	0.158
Webpage (N=19)	4.53	1.26	4.63	0.89	0.658
Both (N=14)	4.64	1.91	4.50	1.79	0.341
Total (N=49)	4.59	1.61	4.41	1.34	0.305

Table 3: Differences in ATT, SN, PBC, and intention scores between time 1 and time 2

Sustainable Behavior	Behavioral Construct	Group	Time 1		Time 2		Time 2 – Time 1
			Mean	SD	Mean	SD	
Eating Local	Attitude Scores	Market	12.69	6.49	12.38	6.42	-0.31
		Webpage	11.05	5.28	13.32	4.89	2.27
		M+W	9.29	6.99	13.93	6.65	4.64
		Total	11.08	6.22	13.18	5.30	2.1*
	Social Norm Scores	Market	2.44	0.54	2.50	0.75	0.06
		Webpage	2.21	1.03	2.63	0.88	0.42
		M+W	2.04	0.57	2.07	0.65	0.03
		Total	2.23	0.77	2.43	0.79	0.2
	Perceived Behavioral Control Scores	Market	3.72	0.83	3.81	0.48	0.09
		Webpage	3.34	0.82	3.50	0.81	0.16
		M+W	3.25	1.17	3.32	0.87	0.07
		Total	3.44	0.94	3.55	0.75	0.11
	Intention scores	Market	3.81	0.83	3.44	0.81	-0.37
		Webpage	2.78	0.97	2.84	1.17	0.06
		M+W	3.79	1.12	3.07	0.83	-0.72*
		Total	3.41	1.08	3.10	0.98	-0.31
Cooking at Home	Attitudes Scores	Market	19.69	8.93	21.27	6.98	1.58
		Webpage	20.89	6.71	23.74	6.79	2.85
		M+W	16.57	12.98	21.38	6.77	4.81
		Total	19.26	9.52	22.27	6.81	3.01*
	Social Norms Scores	Market	2.63	0.56	2.73	0.68	0.1
		Webpage	3.03	0.89	3.08	0.82	0.05
		M+W	2.64	1.05	2.36	1.06	-0.28
		Total	2.78	0.85	2.76	0.89	-0.02
	Perceived Behavioral Control Scores	Market	4.28	0.79	4.33	0.62	0.05
		Webpage	4.21	1.07	4.79	0.38	0.58*
		M+W	4.21	0.91	3.71	1.20	-0.50
		Total	4.23	0.92	4.33	0.88	0.10
	Intention Scores	Market	4.25	0.85	4.07	0.88	-0.18
		Webpage	3.86	1.41	4.23	0.99	0.37

		M+W	3.93	1.14	3.43	1.28	-0.50
		Total	4.02	1.16	3.96	1.09	-0.06
Meatless Meals	Attitude Scores	Market	19.06	9.03	22.93	8.03	3.87
		Webpage	19.71	7.84	23.23	7.68	3.52
		M+W	16.23	13.17	23.10	8.03	6.97
		Total	18.50	9.87	23.09	7.69	4.59**
	Social Norms Scores	Market	2.72	0.85	2.54	1.07	-0.18
		Webpage	2.13	0.88	2.53	0.91	0.40
		M+W	2.00	0.98	2.13	1.05	0.13
		Total	2.30	0.93	2.43	0.99	0.13
	Perceived Behavioral Control Scores	Market	4.34	0.72	4.28	0.58	-0.06
		Webpage	3.88	1.05	4.26	0.77	0.38
		M+W	3.73	1.20	4.13	1.12	0.40
		Total	4.00	1.01	4.24	0.81	0.24
	Intention Scores	Market	3.81	0.91	3.50	1.02	-0.31
		Webpage	3.47	1.12	3.88	1.17	0.41
		M+W	3.31	1.49	3.45	1.51	0.14
		Total	3.54	1.17	3.64	1.21	0.10
**. p <0.01							
*. p <0.05							

Table 4: Differences in specific attitude components for sustainable behaviors between time 1 and time 2 (n=49)

Sustainable Behavior	Attitude Question	Time 1		Time 2		Time 2 – Time 1
		Mean	SD	Mean	SD	
Eating Local	Environment	4.51	3.51	5.22	3.57	0.71
	Cost	2.92	2.13	3.71	2.12	0.79*
	Availability	3.65	3.02	4.24	2.72	0.59
Cooking at Home	Environment	4.18	3.77	4.71	3.35	0.53
	Cost	5.20	3.59	5.83	3.17	0.63
	Preparation	2.47	3.86	3.29	3.00	0.82
	Health	7.41	3.01	8.33	2.36	0.92*
Meatless Meals	Environment	4.37	3.54	5.13	3.63	0.76
	Cost	5.15	3.40	6.14	3.16	0.99*
	Preparation	2.34	3.42	3.09	2.82	0.75
	Health	6.52	3.17	8.07	2.66	1.55*
**. $p < 0.01$						
*. $p < 0.05$						

Table 5: Correlations of ATT, SN, and PBC scores with behavioral intentions scores for time 1 and time 2

Sustainable Behavior	Behavioral Construct	Time 1: Correlation coefficients for Behavioral Intentions	Time 2: Correlation coefficients for Behavioral Intentions
Eating Local	ATT	0.20	0.26
	SN	0.14	0.18
	PBC	0.41**	0.44**
Cooking at Home	ATT	0.55**	0.39**
	SN	0.28	0.27
	PBC	0.71**	0.64**
Meatless Meals	ATT	0.44**	0.32*
	SN	-0.01	0.28
	PBC	0.44**	0.30
**. Correlation is significant at the 0.05 level (2-tailed).			
**. Correlation is significant at the 0.01 level (2-tailed).			

Appendices

Appendix 1: Sustainable Eating Survey

Sustainable Eating Survey

Please answer each question to the best of your opinion or knowledge. Your participation is voluntary and you may choose not to participate, to withdraw at any time, or refuse to answer any question you don't want to.

By providing us with your email, we may contact you in the event that you win the draw. You will also receive an email with an invitation to complete a second survey. Your name or email address will **never** be used during the data analysis process or in dissemination of results (ex: presentation).

_____@_____

Have you visited the **Sustainable Eating webpage** on the Fit@McGill website?	____ Yes _____ No		
Have you already completed an online Sustainable Eating Survey run through Fit@McGill this semester?	____ Yes ____ No		
Please provide your age	____ years		
Please select your gender	☐ Male or ☐ Female		
Please provide your weight	____ kilograms or ____ pounds		
Please provide your height	____ meters or ___ feet ___ inches		
Select your current level of study	☐ Undergraduate ☐ Graduate (Master's or PhD) ☐ Post-doctoral		
Select your faculty of study/research	☐ Agri. Env. Sci. ☐ Arts ☐ Arts & Sci. ☐ Education ☐ Engineering	☐ Environment ☐ Law ☐ Management ☐ Music ☐ Religion	☐ Science ☐ Medicine ☐ Dentistry ☐ Other (not listed above)

Before today, have you ever (select any that apply):	☐ Attended a Sustainable Eating cooking workshop, ☐ Approached a Sustainable Eating kiosk, ☐ Visited the Fit@McGill website, ☐ Volunteered with the Sustainable Eating Project.

The following section is about the foods you usually eat or drink. Think about all the foods you eat, both meals and snacks, at home and away from home.

1. How many portions of fruit and vegetables, of any sort, do you eat on a *typical day*?		___ 1 portion
Examples of fruit portions include:	**Examples of vegetable portions include:**	___ 2 portions
1 medium apple	1 cup raw greens	___3 portions
½ cup canned, frozen or fresh fruit	½ cup fresh, frozen, canned vegetables, or vegetable juice	___ 4 portions
½ cup juice		___5 portions
¼ cup dried fruit		___6 portions
		___7 portions
		___ ≥8 portions

The following questions are going to ask you about eating locally.	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
2. It is important for me to eat food that is healthy.	**1**	**2**	**3**	**4**	**5**
3. It is important for me to eat food that is environmentally-friendly.	**1**	**2**	**3**	**4**	**5**
4. The cost of food is important to me.	**1**	**2**	**3**	**4**	**5**
5. It is important to me that my preferred foods are easily available.	**1**	**2**	**3**	**4**	**5**
6. It is important to me that the meals I want to eat are easy to prepare.	**1**	**2**	**3**	**4**	**5**
7. Choosing local fruits and vegetables (foods grown in within a 500 km radius of Quebec) is more environmentally-friendly than choosing conventional fruits and vegetables.	**1**	**2**	**3**	**4**	**5**
8. Local fruits and vegetables taste better than conventional fruits and vegetables.	**1**	**2**	**3**	**4**	**5**
9. Local fruits and vegetables are more expensive than conventional fruits and vegetables.	**1**	**2**	**3**	**4**	**5**

10. If I wanted to eat local fruits and vegetables, I would have difficulties finding where to buy them.	**1**	**2**	**3**	**4**	**5**
11. I feel under social pressure from friends/peers/family to purchase and consume local foods.	**1**	**2**	**3**	**4**	**5**
12. My friends choose local foods as often as possible	**1**	**2**	**3**	**4**	**5**
13. If I wanted to, it would be possible for me to eat mostly local foods over the next week.	**1**	**2**	**3**	**4**	**5**
14. I am confident that I can choose local foods over the next week.	**1**	**2**	**3**	**4**	**5**
15. I intend to choose local foods as much as possible over the next week.	**1**	**2**	**3**	**4**	**5**

The following questions are going to ask you about preparing your own meals.

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
16. By preparing my own meals, I am eating foods that are healthier than if I did not prepare my own meals.	**1**	**2**	**3**	**4**	**5**
17. By preparing my own meals, I eat food that is more environmentally friendly than if I did not prepare my own meals.	**1**	**2**	**3**	**4**	**5**
18. By preparing my own meals, I am eating food that tastes better.	**1**	**2**	**3**	**4**	**5**
19. By preparing my own meals, I pay more for my total food expenses.	**1**	**2**	**3**	**4**	**5**
20. If I choose to prepare my own meals, I will have difficulties in meal planning and/or preparation.	**1**	**2**	**3**	**4**	**5**
21. I feel under social pressure from friends/peers/family to prepare my own meals as much as possible.	**1**	**2**	**3**	**4**	**5**
22. My friends cook meals at home as often as possible	**1**	**2**	**3**	**4**	**5**
23. If I wanted to, it would be possible for me to prepare my own meals as much as possible over the next week.	**1**	**2**	**3**	**4**	**5**
24. I am confident that I can prepare my own meals over the next week.	**1**	**2**	**3**	**4**	**5**
25. I intend to prepare my own meals as much as possible over the next week.	**1**	**2**	**3**	**4**	**5**

The following questions are going to ask you about eating meatless meals.

26. Do you ever eat chicken, fish or red meat?	☐ **Yes** ☐ **No**

If you answered "Yes" to question #27 above, please continue to answer the next set of questions (– 37).

If you answered "No" to question #27 above, do not complete the next set of questions. You are done the survey.

	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
27. Occasionally eating meatless meals (or meals with less meat) is healthier than not doing so.	**1**	**2**	**3**	**4**	**5**
28. Occasionally eating meatless meals is more environmentally friendly than eating meals with meat.	**1**	**2**	**3**	**4**	**5**
29. Meatless meals can taste better than meals containing meat.	**1**	**2**	**3**	**4**	**5**
30. Eating meatless meals more often is a way for me to save money on groceries.	**1**	**2**	**3**	**4**	**5**
31. If I wanted to eat meatless meals more often, I would have difficulties planning and preparing balanced meals.	**1**	**2**	**3**	**4**	**5**
32. I feel under social pressure from friends/peers/family to eat meatless meals more often.	**1**	**2**	**3**	**4**	**5**
33. My friends eat meatless meals as often as possible	**1**	**2**	**3**	**4**	**5**
34. If I wanted to, it would be possible for me to eat meatless meals more often.	**1**	**2**	**3**	**4**	**5**
35. I am confident that I can prepare meatless meals over the next two weeks.	**1**	**2**	**3**	**4**	**5**
36. I intend to eat meatless meals more often.	**1**	**2**	**3**	**4**	**5**

Appendix 2: Author Guidelines – Environmental Health Perspectives

ehp ENVIRONMENTAL HEALTH PERSPECTIVES

WHO WE ARE

Environmental Health Perspectives (*EHP*) is a monthly open-access journal that publishes peer-reviewed research and news concerning human health and the environment. One of the overarching principles of the journal is to provide a forum for the objective and balanced presentation of scientifically credible information. Although *EHP* is sponsored by the National Institute of Environmental Health Sciences (NIEHS), its editorial policies are independent of the institute.

In 2004 *EHP* became an open-access journal. All content published since the beginning of the journal in 1972 is available free online. *EHP* is committed to promoting the discussion and exchange of information internationally.

WHAT WE PUBLISH

The environmental health sciences include many fields of study and increasingly comprise multidisciplinary research areas. *EHP* publishes articles from a wide range of scientific disciplines encompassing mechanistic research, experimental and observational human studies, and *in vitro* and *in vivo* animal research with a clear relationship to human health effects. Studies involving exposure science, climate change, ecologic issues, or effects on wildlife populations are welcome, but the relevance of the findings to human health should be made clear. *EHP* also addresses ethical, legal, social, and policy issues related to environmental public health. Because children are uniquely sensitive to their environments, *EHP* devotes a research section specifically to issues surrounding children's environmental health.

EHP provides additional information on environmental health issues through its News and Editorials. Although *EHP* welcomes ideas for News and Editorials, the journal does not accept unsolicited manuscripts of these types. Please contact the Editor-in-Chief for further information.

MANUSCRIPT PREPARATION

Article Length

All words in the main text, title pages, abstract, tables, and references count toward *EHP* word limits. In addition, each figure is counted as 250 additional words. Manuscripts that do not conform to the word limits may be returned to the author(s) for revision before the review process is initiated. Depending on the topic and potential impact of a paper, the Editor-in-Chief reserves the right to waive word limits. Authors should consider placing some types of information such as lengthy descriptions of previously published methods into Supplemental Material; however, these methods must be summarized briefly in the text of the paper. Information included in Supplemental Material does not count toward the word limit. The judicious use of references also may help meet the following word limits:

- Correspondence: ≤ 750 words
- Commentaries: ≤ 5,000 words
- Research Articles: ≤ 7,000 words
- Emerging Issue Reviews: ≤ 5,000 words
- Substantive Reviews: ≤ 10,000 words
- Quantitative Reviews and Meta-Analyses: ≤ 10,000 words
- Reviews Based on Meetings or Conferences: ≤ 10,000 words

Parts of a Manuscript

Title Pages

The title pages should include the following items in the order shown, beginning on the first page of the manuscript:

- Manuscript title, not to exceed 20 words [titles generally should not contain abbreviations or numerical values, with the exception of abbreviated study names (e.g., NHANES)]
- Names of the authors spelled out in full
- Affiliations of all authors (department, institution, city, state/province, and country)
- Name of and contact information for corresponding author to whom page proofs should be sent, including complete address for express mail service, telephone number, and e-mail address
- A short running title, not to exceed 50 characters and spaces
- 5–10 key words, listed in alphabetical order, for indexing purposes
- Acknowledgments, including grant information
- A competing financial interests declaration
- A list of relevant abbreviations and definitions used in the manuscript.

Abstract

All papers must include a structured abstract of ≤ 250 words, which should not contain references. No information should be reported in the abstract that does not appear in the text of the manuscript. In general we recommend that authors indicate study names or sources of data that are integral to the study in the title or abstract. Conclusions should mention the relevance of the work to environmental health science. Headings to be used in the structured abstracts vary by article type as described below:

- Commentaries: Background, Objectives, Discussion, Conclusions
- Research Articles, Quantitative Reviews, and Meta-Analyses: Background, Objectives, Methods, Results, Conclusions
- Substantive Reviews, Emerging Issue Reviews, and Reviews Based on Meetings or Conferences: Background, Objectives, Methods, Discussion, Conclusions

Main Text

The organization of the text will vary by article type and roughly reflects the structure of the abstract with some exceptions as described below:

- Commentaries: Introduction (comprising the Background and Objectives stated in the abstract), Discussion, Conclusions
- Research Articles: Introduction (comprising the Background and Objectives stated in the abstract), Methods, Results, Discussion, Conclusions. Concise subheadings (≤ 8 words each) may be used to designate major topics within each of these sections; do not include tables and figures in these headings.
- Reviews: Introduction (comprising the Background and Objectives stated in the abstract), Methods (including data sources), Results (as appropriate), Discussion, Conclusions

References, Tables, Figures, and Supplemental Material

The following items should be provided after the main text of the paper in this order: References, Tables, Figure Legends, Figures, Supplemental Material. The References, Tables, and Figure Legends must each begin on a new page of the manuscript. Figures and Supplemental Material should be provided as separate files. Additional information concerning each of these sections is provided in *EHP* Style below.

Conformance to* EHP *Style Guidelines

Manuscripts submitted to *EHP* must conform to all *EHP* style requirements as described in *EHP* Style below. Authors should take special note of requirements for citations and references, figures, and tables. Manuscripts that do not conform to style requirements may be returned to the authors for modification before the initiation of the peer-review process. This step

will cause a significant delay in the review and possible acceptance of the manuscript. All manuscripts must be submitted to *EHP* in English.

Manuscript Formatting

Manuscript pages must be numbered consecutively, beginning with the title page, and lines should be numbered in the original submission and all subsequent revisions. The manuscript must be prepared using Times New Roman font at 12-point size. The manuscript must be double-spaced, with all margins set at 1 inch.

For additional information, see the *AMA Manual of Style: A Guide for Authors and Editors*, 10th edition (American Medical Association 2007). A basic source for spelling is *Merriam-Webster's Collegiate Dictionary*, 11th edition.

Resources for assistance with research, presentation, and language are available from the following organizations:

- International Committee of Medical Journal Editors (*Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Writing and Editing for Biomedical Publication*)
- AuthorAID.

EHP *STYLE*

Plain Language

EHP covers all disciplines engaged in the broad field of environmental health sciences. Therefore, authors should write in a clear and simple manner, in the active voice, and avoid unnecessary jargon, so the article is understandable to readers in other disciplines and to those whose first language is not English. In deference to the breadth of the journal's readership, please define terms that may not be universally recognized among all environmental health scientists.

Clearly define all outcomes, exposures, predictors, confounders, and covariates, and describe the methods or assays used to characterize study data. Results should be presented in a clear and unambiguous manner. Comparison groups or reference conditions should be clearly indicated when reporting measures of association or effect and when reporting *p*-values for statistical tests comparing outcomes or effects between groups.

We recommend against the use of "-fold" terminology because it can be difficult to determine whether it is being used to describe relative versus absolute differences or changes between groups or conditions.

Whenever possible, provide an estimate of variability or precision when reporting measures of association or central tendency (e.g., confidence intervals, standard deviations, interquartile ranges), regardless of whether *p*-values are also reported for these estimates.

Abbreviations

All abbreviations, including abbreviations for elements (e.g., Fe, Cu) and chemical compounds [e.g., polychlorinated biphenyls (PCBs), carbon dioxide (CO_2)], should be defined in the text on first use with abbreviations used thereafter.

Units of measure should be abbreviated only when a specific amount is given (e.g., "concentration of 10 ng/mL" versus "units of nanograms per milliliter").

In-Text Citations and Reference Lists

References and citations must be formatted according to *EHP* style as described below. This will reduce copyediting time and the number of author queries included in page proofs. Authors should double-check all references for accuracy and completeness of information, spelling, diacritical marks, symbols, subscripts/superscripts, and italics. Authors are fully responsible for the accuracy of their references.

In-Text Citations

All in-text citations must be in name/date form. Place the citation immediately after the textual information cited, placing name and date within parentheses without a comma.EndNote is a useful source for *EHP* reference style.

- Single author: (Wing 2002)
- Two authors: (Wing and Wolf 2000)
- Three or more authors: Use first author's last name plus "et al." (Wing et al. 2008)
- Multiple sources cited at one time: List publications alphabetically by author in the citation. Separate publications by the same author(s) with commas and those by different authors with semicolons: (Aldridge et al. 2005; Jameson et al. 2006; Levin et al. 2007; Slotkin 2004a, 2004b; Slotkin et al. 2008)
- Multiple sources cited at one time with different first authors but same last name and date: Use first author's last name plus initial(s) (Smith A 2000; Smith J 2000).

Provide references for any quotations used in the text. For example:

According to Rubin et al. (2001), "it is only with a multidisciplinary and collaborative approach that the environmental and public health significance of *Pfiesteria* will be fully understood."

All manuscripts submitted but not yet accepted, unpublished data, and personal communications—any items that must be cited but are not accessible to the public—must appear in the text in parentheses but should not be listed in the references: (Ramsdell JS, Moeller PDR, personal communication); (Reeves MK, unpublished data).

Reference List

Authors are fully responsible for the accuracy of their references. The list of references should begin on a new page after the Conclusions of the manuscript. All references must include

- Author/editor last name plus initials (for six or fewer authors; if there are more than six authors, use "et al." after the sixth) or authoring agency
- Year of publication
- Full title of article or chapter (lower case)
- Title of journal (abbreviated according to BIOSIS, *Index Medicus*, or PubMed) or book/proceedings in title case
- For books and meeting reports, city/state/country of publication and name of publisher
- Volume and inclusive page numbers
- DOI number, if available, with online publication date; this information is required for articles published online only.

If you are uncertain what to include, please include all information.

List references alphabetically by the last name of the first author. If the first author has more than one publication, list references in alphabetical order (letter by letter) of subsequent authors. If the first author shares the last name with another first author (Smith JM vs. Smith RB), alphabetize by initials. If you list more than one publication by the same author/group of authors, arrange publications by date, early to late. If you list more than one publication published in the same year by the same author/group of authors, use a, b, c, and so on to distinguish the publications.

Sample Alphabetical List

Slotkin TA. 2004a. Cholinergic systems in brain development and disruption by neurotoxicants: nicotine, environmental tobacco smoke, organophosphates. ToxicolApplPharmacol 198:132–151.

Slotkin TA. 2004b. Guidelines for developmental neurotoxicity and their impact on organophosphate pesticides: a personal view from an academic perspective. Neurotoxicology 25:631–640.

Slotkin TA. 2005. Developmental neurotoxicity of organophosphates: a case study of chlorpyrifos. In: Toxicity of Organophosphate and Carbamate Pesticides (Gupta RC, ed). San Diego:Elsevier Academic Press, 293–314.

Slotkin TA, MacKillop EA, Ryde IT, Tate CA, Seidler FJ. 2007. Screening for developmental neurotoxicity using PC12 cells: comparisons of organophosphates with a carbamate, an organochlorine and divalent nickel. Environ Health Perspect 115:93–101.

Slotkin TA, Persons D, Slepetis RJ, Taylor D, Bartolome J. 1984. Control of nucleic acid and protein synthesis in developing brain, kidney, and heart of the neonatal rat: effects of a difluoromethylornithine, a specific, irreversible inhibitor of ornithine decarboxylase. Teratology 30:211–224.

Slotkin TA, Seidler FJ. 2007. Comparative developmental neurotoxicity of organophosphates *in vivo*: transcriptional responses of pathways for brain cell development, cell signaling, cytotoxicity and neurotransmitter systems. Brain Res Bull 72:232–274.

Types of References

Journal article—conventional reference

Lewin SW, Arthur JR, Riemersma RA, Nicol F, Walker SW, Millar EM, et al. 2002. Selenium supplementation acting through the induction of thioredoxinreductase and glutathione peroxidase protects the human endothelial cell. BiochimBiophysActa 1593:85–92.

Journal article—DOI reference

Fanshawe TR, Diggle PJ, Rushton S, Sanderson R, Lurz PWW, Glinianaia SV, et al. 2007. Modellingspatio-temporal variation in exposure to particulate matter: a two-stage approach. Environmetrics; doi:10.1002/env.889 [Online 17 December 2007].

Journal article—conventional reference and DOI reference

Berglund M, Lind B, Björnberg KA, Palm B, Einarsson Ö, Vahter M. 2005. Inter-individual variations of human mercury exposure biomarkers: a cross-sectional assessment. Environ Health 4:20; doi:10.1186/1476-069X-4-20 [Online 3 October 2005].

Journal article, "in press"

Theppeang K, Glass TA, Bandeen-Roche K, Todd AC, Rohde CA, Schwartz BS. In press. Sex and race/ethnicity differences in lead dose biomarkers: predictors of lead in blood, tibia, and patella in older, community-dwelling adults in an urban setting. Am J Public Health.

Chapter in edited book

Clark K, Cousins I, MacKay D, Yamada K. 2003.Observed concentrations in the environment.

In: The Handbook of Environmental Chemistry, Vol 3, Part Q: Phthalate Esters (Staples CA, ed). New York:Springer, 125–177.

Agency as author

Institute of Laboratory Animal Resources. 1996. Guide for the Care and Use of Laboratory Animals. 7th ed. Washington, DC:National Academy Press.

Proceedings

Zaslavsky I, Pezzoli K, Valentine D, Lin A, Sarabia H, Ellisman MH, et al. 2006. Integrating GIS and portal technologies for assessing environmental health impacts of Hurricane Katrina. In: Proceedings from the Second International Conference on Environmental Science and Technology, 19–22 August 2006, Houston, TX, Vol 2 (Starrett SK, Hong J, Lyon WG, eds). Houston, TX:American Science Press, 385–390.

Website

NTP (National Toxicology Program). 2008. NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Bisphenol A. NIH Publication no. 08-5994. Available: http://cerhr.niehs.nih.gov/evaluations/chemicals/bisphenol/bisphenol.pdf [accessed 24 June 2010].

(Additional reference samples are available below.)

Footnotes

Do not use footnotes. Place all textual information within the manuscript and all references in the proper form both in text and in the reference list.

Preparing Tables and Figures

Tables

Each table must begin on a new page after the References. Tables must be numbered with Arabic numerals, followed by a brief title (not to exceed 25 words). Tables should contain no more than three layers of column headings, and the entire table should fit on one journal page or less. Large tables may be published online as Supplemental Material. A column heading must be provided for each column. Rather than placing additional column heads in the middle of a table, a new table should be created. Tables must be created using the Table feature in Microsoft Word. List abbreviations and definitions under each table. Type footnotes directly after the abbreviations, beginning on the next line. General footnotes to tables must be indicated by lowercase superscript letters beginning with “a” for each table. Footnotes indicating statistical significance must be identified in the following order: asterisks (*, **), number signs ($^{\#}$, $^{\#\#}$), and daggers (†, ††). The comparison to which the *p*-value applies must be clearly indicated (e.g., “compared with untreated controls”). For presentation of data in tables, please use the “±” symbol for

arithmetic mean and standard deviation or standard error (e.g., "mean ± SE") and parentheses for the standard error when presented with the geometric mean [e.g., "GM (SE)"]. Please present number and percent as "*n* (%)" (i.e., in one column separated with one space). Confidence intervals should be presented in parentheses in the same column as the point estimate, with the upper and lower bounds separated by a comma [e.g., (0.1, 2.3)].

Figure Legends

Figure legends should be provided on a new page after tables. Each figure legend should include a title for the entire figure and descriptors for each panel [e.g., "Figure 1. Incidence of hepatocellular adenomas (*A*) and carcinomas (*B*) in mice exposed to DEHP"]. Define error bars and any abbreviations not defined in the text. Footnotes indicating statistical significance must be identified in the following order: asterisks (*, **), number signs (#, ##), and daggers (†, ††). The comparison to which the *p*-value applies must be clearly indicated (e.g., "compared with controls from the corresponding age group"). Type footnotes directly after the abbreviations beginning on the next line.

Figures

Each figure must be provided as a separate file in one of the following formats: TIFF, JPG, EPS, or PDF. Do not embed figures in the main text (Microsoft Word) file. Each figure must be labeled with the figure number. For TIFF or JPG format, the resolution should be 300 dpi for color images, 600 dpi for grayscale images, and 1200 dpi for line art (black-and-white art). JPG files should be saved on the "highest quality" setting. Color images should be RGB and saved at a minimum of 8 bits per channel. Because figures may be reduced or enlarged to fit our layouts, sufficient resolution is essential. Vector images should be saved as editable EPS files. Any images embedded in the EPS should also be included in a separate file. Do not convert text to path outlines before submission.

Graphics must fit standard letter-size paper (8.5 × 11 inches, portrait orientation). Multiple panels within a figure also must fit on a single page. All letters, numbers, and lines must be clearly legible and easy to differentiate. Provide a key defining representational elements (e.g., dotted/dashed lines, symbols) for each figure. All axes must be clearly labeled, giving both the measure and the unit of measurement where applicable. Consistency among terms and styles (including symbols and colors) used in figures is desirable. For example, if a black circle represents the control in Figure 1, a black circle (or a black bar) should be used for controls in all other figures. Photomicrographs should include a scale bar in each image, and the length should be specified in the typed figure legend (e.g., "bar = 10 μm").

EHP editors reserve the right to request that complex figures (e.g., figures with multiple panels showing information in a variety of formats, or that include panels related to different

experiments) be divided into separate figures for publication. Questions concerning figures should be directed to EHPmanuscripts@niehs.nih.gov.

Image Integrity

Adjusting an image for brightness and contrast is acceptable if it is applied to the entire image. Background data of gels and blots must not be removed. The final image must accurately represent the original data.

Supplemental Material

EHP welcomes reasonable amounts of material suitable for inclusion as online documentation for submitted manuscripts. Examples are bioinformatic data, formulae, statistical derivations, full gene data and analysis, additional high-resolution microscopic data, kinetic analyses, and other supporting tables, figures, or videos. The submitted manuscripts must be able to stand alone in the absence of Supplemental Material. All information included as Supplemental Material should be directly relevant to the article and cited in the main body of the paper. The principal methodological approach must be clearly described in the main body of the paper and not relegated to Supplemental Material.

Supplemental Material must not exceed 2,000 words, including text, tables, references, and figure legends plus an additional 250 words per figure. If the Supplemental Material exceeds this limit, the author must request a waiver from the Editor-in-Chief before the paper is submitted to the journal. Authors may provide a separate (ideally permanent) web repository for information that is not included in the Supplemental Material file if they believe it would be of interest to readers. This material should be clearly identified as not peer reviewed. This information should be cited in the text and included in the reference list (formatted as a website).

Information included as Supplemental Material does not count toward the word count for the paper. Supplemental Material must be uploaded as a separate single PDF file and labeled as such. Supplemental Material will be peer reviewed along with the manuscript and thus must meet the same rigorous standards.

Supplemental Material PDF files are linked to papers through a common DOI number. We use Supplemental Material files "as is" (i.e., *EHP* will not copyedit or reformat the file). Therefore, please carefully check files to confirm that they are complete, accurate, and ready for publication.

- Provide a single Supplemental Material file in PDF format.
- Begin the file with a title page that indicates "Supplemental Material" followed by the title of the paper and the author list.
- Include page numbers, but remove all line numbers before generating the PDF file.

- Provide a Table of Contents (on or after the title page) if the Supplemental Material comprises multiple tables, figures, and/or sections of text.
- Place figure legends below corresponding figures. Landscape (versus portrait) layout may be used when needed.
- Tables or figures included in the Supplemental Material should be labeled as Supplemental Material, Table S1; Supplemental Material, Figure S1; and so on.
- When referring to Supplemental Material in the main manuscript, indicate the table, figure, or section as follows: See Supplemental Material; see Supplemental Material, Table S1; see Supplemental Material, p. 6; see Supplemental Material, Part 2.
- A separate reference list must be included in the Supplemental Material file for any sources cited in the Supplemental Material, even if they are cited in the main paper.

Public Databases

Manuscripts using microarrays must follow the Minimum Information About a Microarray Experiment (MIAME) guidelines developed by the Microarray Gene Expression Data (MGED) Society. On acceptance, all integral data supporting the article's conclusions should be submitted to either the ArrayExpress or GEO database.

Appendix 3: Abstract for project presentation

Promoting the advantages of sustainable and healthy eating using food demonstration kiosks and webpage interventions

M.Sc.A Project Presentation, 10:05 a.m. (R2-046)
April 30th, 2013
Claire Chartrand, M.Sc. Applied Candidate
Supervisor: Hugues Plourde, PhD, RD and Mary Hendrickson-Nelson, MSc, RD

Background: Sustainable eating behaviors such as eating locally, cooking at home, and eating meatless meals offer both environmental and health benefits. Studies have found university students display a lack of knowledge about how to eat sustainably and do not consider it important [1,2]. Many students also frequently rely on processed and packaged unsustainable foods as a source of nutrition, resulting in poor dietary quality [3]. Past research has demonstrated that university students who report sustainable eating as important have associated improvements in dietary quality; such as a higher intake of fruit, vegetables, and fiber, and lower intakes of sugars, fats, and calories [4]. Nutritional interventions that target increasing sustainable eating behaviors offer an opportunity to help preserve environmental resources while improving dietary quality of university students.

Objectives: (1) To increase students' intentions to eat locally, cook at home, and eat meatless meals through the use of two interventions: a webpage with video messages, and an informational kiosk with food demonstrations; (2) To compare the efficacy of each intervention to improve sustainable eating behaviors; and (3) To increase students fruit and vegetable intake as a secondary outcome to eating more sustainably.

Methods: Questionnaires assessing demographics, fruit and vegetable intake, attitudes (ATT), social norms (SN), perceived behavioral control (PBC), and behavioral intentions (INT) of participants to eat local, cook at home, and eat meatless meals were completed by students before and after attending the Sustainable Eating Kiosk and/or Webpage. Data was analyzed based on intervention exposure, Market Group (n=16), Webpage Group (n=19), and Market + Webpage group (n=14); and combined study group (n=49). Descriptive statistics were used to describe the demographic profile of the participants. Wilcoxin Signed Rank tests were performed to determine if there was a difference in ATT, SN, PBC, and INT scores, and fruit and vegetable intake overtime. Partial correlations were performed to assess associations between INT scores with ATT, SN, and PBC scores.

Results: The specific intervention groups were not successful in increasing ATT, SN, PBC, or INT scores. However, when analyzing the combined total study group, the interventions were successful in increasing students' ATT scores for eating local, cooking at home, and eating meatless meals. More specifically, students' attitudes towards the cost and health benefits of each of these sustainable behaviors improved. ATT and PBC scores were significantly correlated with INT scores for all three sustainable eating behaviors, while SN was not. Fruit and vegetable intake did not increase overtime, and was approximately 4.5 servings per day.

Conclusion: Educational farmers' market kiosks and webpages with video messages can be implemented into community nutrition interventions to increase university students' attitudes towards sustainable eating. However in order to increase students' intentions to eat sustainably, it may be necessary to improve their self efficacy through the use of interactive hands on learning components within interventions.

References:

1. Pearson, D., et al. (2010). Sustainable consumption in Australia: What do Generation Y consumers know about their food choices? Australian and New Zealand Marketing Academy (ANZMAC) Conference Christchurch New Zealand.
2. Bissonnette, M. and I. Contento (2001). "Adolescents' Perspectives and Food Choice Behaviors in Terms of the Environmental Impacts of Food Production Practices: Application of a Psychosocial Model." Journal of Nutrition Education **33**(2): 72-82.
3. Larson, N., et al. (2011). "Young Adults and Eating Away from the Home: Associations with Dietary Intake Patterns and Weight Status Differ by Choice of Restaruant." Journal of the American Dietetic Association**111**: 1696-1703.
4. Pelletier, J., et al. (2013). "Positive Attitudes toward Organic, Local, and Sustainable Foods Are Associated with Higher Dietary Quality among Young Adults." Journal of the Academy of Nutrition and Dietetics**113**: 127-132.

Appendix 4: Slides from project presentation

PROMOTING THE ADVANTAGES OF SUSTAINABLE AND HEALTHY EATING USING FOOD DEMONSTRATION KIOSKS AND WEBPAGE INTERVENTIONS

Claire Chartrand
MSc (A) Candidate
April 30th, 2013

Co-supervisors:
Hugues Plourde PhD, RD
Mary Hendrickson-Nelson MSc, RD

What is Sustainable Eating?

"Making food choices that are healthy, do not harm the environment, respect workers, are humane to animals, and supports local farmers in your area."

– Sustainable Table

How Can Students Eat Sustainably?

Eating Local

Cooking at Home

Eating Meatless Meals

Minimizing Food Packaging

Reducing Food Waste

Why is it Important to Educate Students (16-25 y.o) About Sustainable Eating?

Currently:

- Purchase food from restaurants 3-4x / week
- High reliance on processed and packaged foods
- Do not meet the recommendations for fruit and vegetable intake

Students who consider sustainable eating important:

- **Increased intake of fruit and vegetables (1.3 servings/day)**
- **Decreased intake of refined sugars, fat, sweetened drinks**

- Confusion surrounding the term "Sustainable Eating"
- Unaware of how to eat sustainable
- Do not consider sustainable eating important

Do not feel responsible and low intention to purchase sustainable foods

(Pearson 2010, Robinson&Smith 2002; Pelletier 2013; Bissonette&Contento 2001)

How Can Students Eat Sustainably?

Eating Local

Cooking at Home

Eating Meatless Meals

This study will focus on teaching students about:
Eating Local, Cooking at Home, Eating Meatless Meals

- Encompass minimizing food packaging and reducing food waste
- Easy for students to incorporate into their daily lives
- Promote fruit and vegetable intake
- Lack knowledge about the importance these behaviors (Pearson 2010)

Eating Local

Currently:

- High international imports and exports of food to meet consumer demands

Environmental Benefits

- Reduces the miles food travels from farm to plate
- Reduces the amount of fuel used in transport, and CO_2 emissions

Health Benefits

Increased access to farmers community farmers markets is associated with:

- Decreased prevalence of obesity
- Increased fruit and vegetable intake

(Pirog 2001; Rundle et al 2009; Jilcott et al 2011; Evans et al 2012)

Cooking at Home

Currently:

- 88% of university students consume fast food weekly
- 21% of male and 33% of female young adults buy fresh fruit and vegetables weekly
- Lack confidence in cooking skills

Environmental Benefits

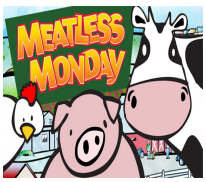
- Decreased reliance on processed and packaged foods that require large energy inputs in products, distribution and disposal

Health Benefits

- In young adults, the frequency of cooking at home is associated with better diet quality

(Larson et al 2006; Larson et al 2011; Chenhall 2011; Engler-Stringer 2009)

Eating Meatless Meals



Currently:

- High consumption of meat (3.5-4.5 servings/day)
- Global meat consumption is predicted to double by 2050

Environmental Benefits:

- Plant based protein requires lower inputs from energy, water, and land/soil for production

Health Benefits:

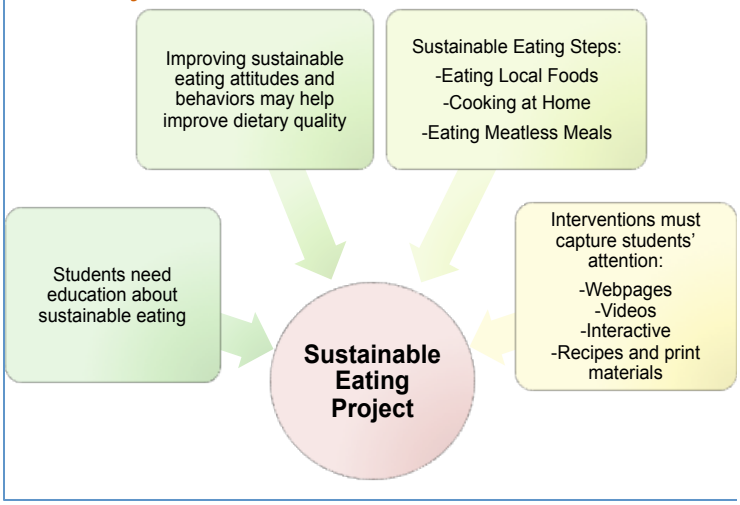
- Low in saturated fat and cholesterol
- High in fiber and essential nutrients
- Decrease risk of chronic disease

(Steinfeld et al 2006; Daniel 2010; Health Canada 2008; ADA 2009; Pimentel 1997, 1998, 2003)

Nutrition Communication Channels to Promote Behavior Change

Author	Objectives	Methods	Conclusion
Silk et al 2008	To improve nutrition knowledge	N=155 webpage, print materials, and a video game	The webpage was the most effective at improving nutrition knowledge scores, and was ranked highly for likability and intention to use
Nichols& Schmidt 1995	To educate consumers about fat and cholesterol	N=1447 Brochures, videos, and recipes in grocery stores.	Short videos, recipes, and brochures were successful in increasing nutrition knowledge
Hanss & Bohm 2013	To increase intentions to purchase sustainable groceries	N=145 Online informational intervention	Online intervention was successful at increasing consumers intentions and actual purchase of sustainable foods by improving their knowledge/ attitudes
Eastman 2012	To improve students' attitude and sustainable dietary habits	N=191 Four 5-minute online modules	Suggestions for future interventions: - Provide recipes - Videos - More interactive

Study Rationale



Objectives

1. To increase university students' intentions to eat locally, cook more meals at home, and eat more meatless meals through the use of:
   a. Educational webpage with video messages
   b. Farmers' market kiosk with food demonstrations
2. To compare the efficacy of each intervention to improve sustainable eating intentions
3. To increase students' fruit and vegetable intake

Predicted Outcomes

Primary outcome

Both interventions (Webpage and Market kiosk) will increase students' intentions eat local foods, cook at home, and eat meatless meals more often

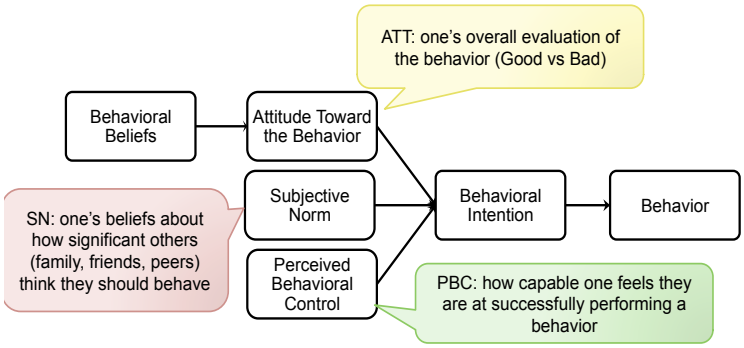
Secondary outcome

There will be an increase in fruit and vegetable intake

The Theory of Planned Behavior

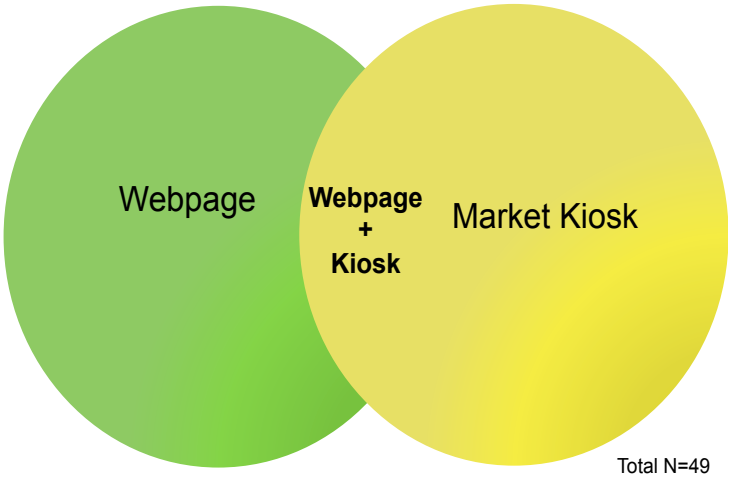
TPB:

A model of behavior change that is used to predict one's intention and motivation to perform a specific behavior



(Ajzen 1991; Kellar&Abraham 2005)

Study Design



Total N=49

Intervention: Market Kiosk + Food Demonstration

.ocation: McGill 'armers' Market

ATT

- Printed informational material about sustainable eating

PBC:

- 5 steps to sustainable eating on posters
- Take home recipe cards
- Food demonstrations

SN:

- Peer education by dietetic stagieres

Intervention: Webpage + Videos

Fit@Mcgill

ATT:

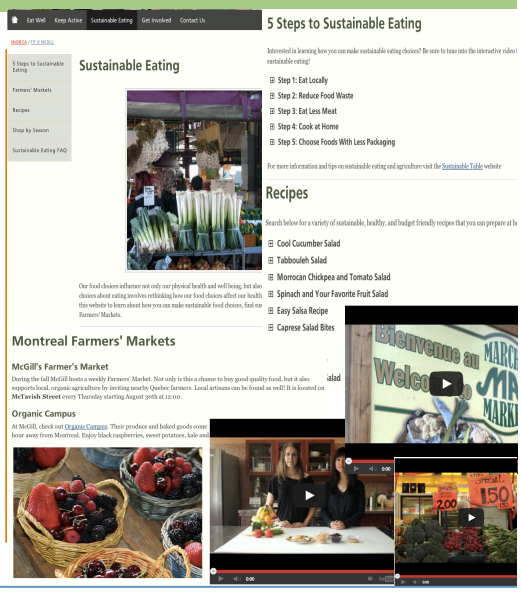
- Information about the importance of sustainable eating
- FAQ
- Website links

PBC:

- 5 steps to sustainable eating in videos
- Locations of sustainable food outlets
- Recipes

SN:

- Peer education



Data Collection

Sample Size Calculation:
$n=[2(Z_{1-\alpha/2} + Z_{1-\beta})^2 * \sigma^2] / (\mu_1 - \mu_2)$
n= 229

α= 0.05
1-β = 0.80
σ= 1.206, $\mu_1 - \mu_2$ = 0.1

August 30th
- Farmers' market kiosks begin (9 weeks total)
- Webpage on Fit@ McGill is activated

Data Collection
- Recruitment: McGill students can fill out the baseline survey:
  - Sustainable Eating Webapge
  - McGill Farmers' Market

November 1st
- Participants are contacted via email with the follow up survey (same as the baseline survey)
- Participants indicate on the survey whether they have visited (a) Kiosk, (b) Webpage, (c) Both

December 1st
- Participants are divided into three study groups based on intervention exposure:
  - **Market Group (MG) (N=16)**
  - **Webpage Group (WG) (N=19)**
  - **Market + Webpage Group (MWG) (N=14)**

Survey (Adapted from McDonough 2012)

Component	Question Items
Demographics	Age Gender Body weight and height Faculty Fruit and vegetable intake
Attitude (3-4)	*Outcome Evaluations*: how important a behavior is to an individual - "The cost of food is important to me"
	Behavioral Beliefs: belief about the consequences of performing a certain behavior - "By preparing my own meals, I pay more for my total food expenses"
Social Norms (2)	Beliefs about how significant others (family, friends, peers, etc) think they shoul behave - "I feel under social pressure from friends/peers/family to prepare my own meals as much as possible" - "My friends cook meals at home as often as possible"
Perceived Behavioral Control (2)	How confident an individual feels in their ability to perform a behavior - "If I wanted to, it would be possible for me to prepare my own meals as muc as possible over the next week" - "I am confident that I can prepare my own meals over the next week"
Intentions (1)	"I intend to prepare my own meals as much as possible over the next week"

Data Analysis

- IBM® SPSS® Statistics 18.0.0
- Descriptive statics for the demographic profile
- Tabulation of over all scores for each behavioral construct
  - Combined study group
  - Market Group (MG)
  - Webpage Group (WG)
  - Market+Webpage group (MWG)
- Exploratory tests for normal distribution (data was non parametric)
- **Wilcoxin rank test**: determine changes over time in ATT, SN, PBC, INT, and F&V intake
- **Spearman correlation**: assess associations between
  - INT and ATT/PBC/SN
  - Number of videos watched and INT/ATT/PBC/SN

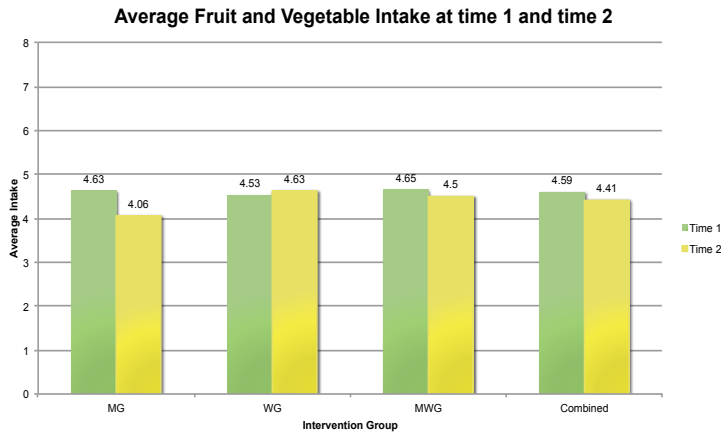
Results: Demographics

		Total (%) N=49	MG (%) N=16	WG (%) N=19	MWG (%) N=14
Gender	Female	79.6	81.3	89.5	64.3
	Male	16.3	18.8	10.5	24.1
	No Response	4.1	0	0	14.3
Age	<18	4.1	12.5	0	0
	18-25	73.5	68.7	84.2	64.3
	>25	22.4	18.8	15.8	35.7
BMI	<18.5	4.1	6.3	5.3	0
	18.5-25	81.6	87.4	73.7	85.7
	>25	12.2	6.3	21	7.2
	No response	2	0	0	7.2

Results: Demographics

		Total (%) N=49	MG (%) N=16	WG (%) N=19	MWG (%) N=14
Faculty	Agr & Env Sci	12.2	12.5	15.8	7.1
	Arts	32.7	31.3	31.6	35.7
	Education	4.1	6.3	0	7.1
	Engineering	8.2	0	15.8	7.1
	Management	6.1	6.3	5.3	7.1
	Science	16.3	12.6	10.5	28.6
	Other	22.5	31.3	21.2	7.1
Vegetarian	No	93.9	100	89.5	92.8
	Yes	6.1	0	10.5	7.3
F&V Intake	< 7 servings/day	90	87.3	94.8	85.7
	> 7 servings/day	10	12.5	5.2	14.3

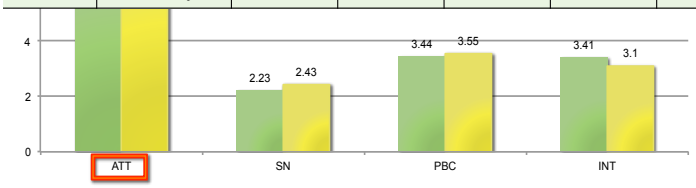
Results: Fruit and Vegetable Intake



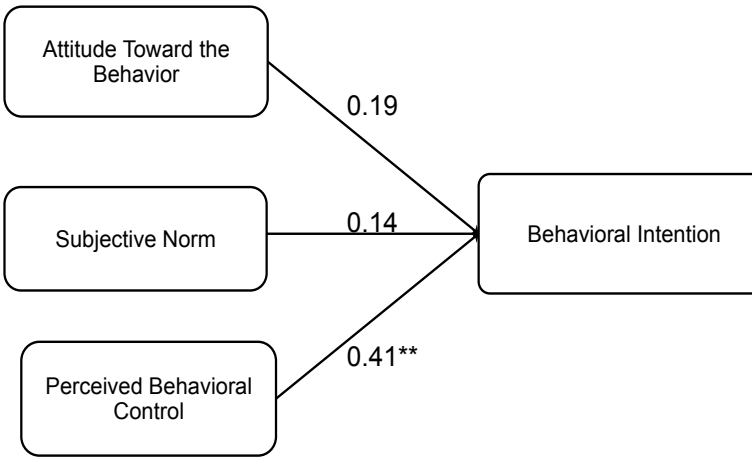
Results: Eating Local

Change in behavioral construct scores for eating local from time 1 to time 2 (N=49)

	Attitude Question	Time 1		Time 2		Time 1 – Time 2
		Mean	SD	Mean	SD	
Eating Local	Environment	4.51	3.51	5.22	3.57	0.71
	Cost	2.92	2.13	3.71	2.12	0.79*
	Availability	3.65	3.02	4.24	2.72	0.59



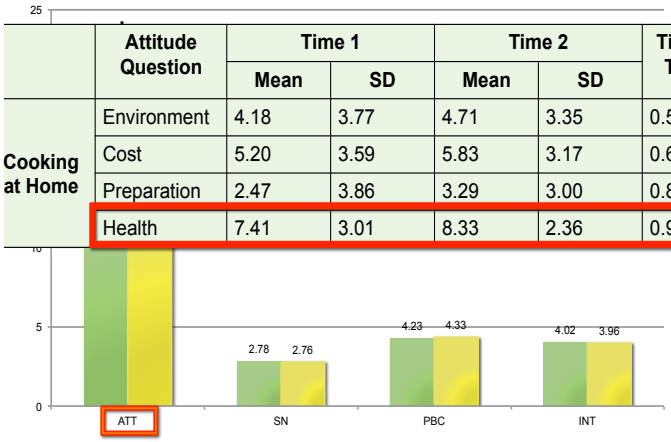
Results: Eating Local



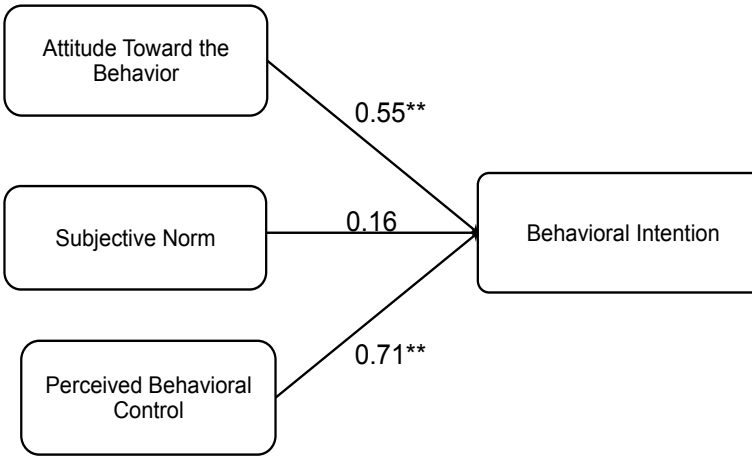
Results: Cooking at Home

Change in behavioral construct scores for cooking at home from time 1 to time 2 (N=49)

	Attitude Question	Time 1		Time 2		Time 1 – Time 2
		Mean	SD	Mean	SD	
Cooking at Home	Environment	4.18	3.77	4.71	3.35	0.53
	Cost	5.20	3.59	5.83	3.17	0.63
	Preparation	2.47	3.86	3.29	3.00	0.82
	Health	7.41	3.01	8.33	2.36	0.92*



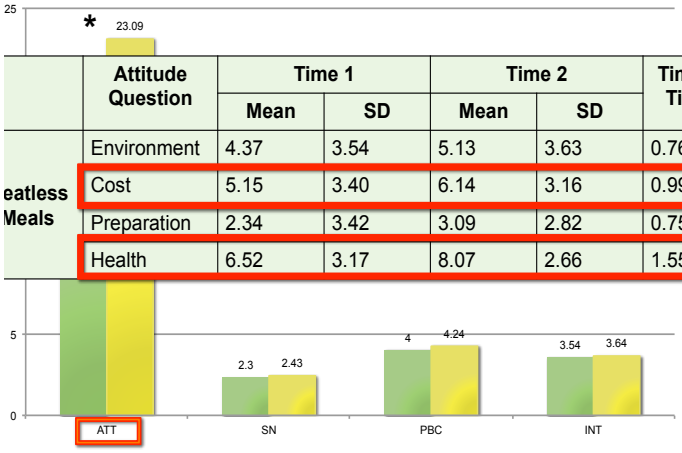
Results: Cooking at Home



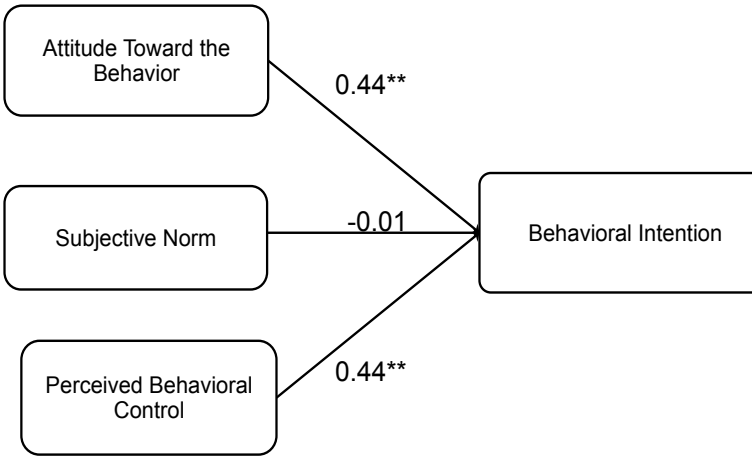
Results: Meatless Meals

Change in behavioral construct scores for meatless meals from time 1 to time 2 (N=49)

	Attitude Question	Time 1		Time 2		Time 1 – Time 2
		Mean	SD	Mean	SD	
eatless Meals	Environment	4.37	3.54	5.13	3.63	0.76
	Cost	5.15	3.40	6.14	3.16	0.99*
	Preparation	2.34	3.42	3.09	2.82	0.75
	Health	6.52	3.17	8.07	2.66	1.55*



Results: Meatless Meals



Discussion: Fruit and Vegetable Intake

Many students did not meet Canada's Food Guide recommendations. Similar findings in other studies.

- 0% of males
- 10.2% of females

Why?

1. Intentions to eat sustainably did not increase
2. Survey 2 was completed near exam time. High stress levels have been associated with poor dietary quality
3. Intervention messages were not directly targeted to increasing fruit and vegetable intake

(McDonough 2012; Pelletier 2013; Mikolajczyk 2009; Cilisk 1999)

Discussion: Changes in Behavioral Constructs

Attitudes

- Information consisted of why it is important to eat sustainably (health and environmental outcomes)
- Informational interventions improve knowledge → change attitudes

Social Norms

- There are many social influences that contribute to dietary behaviors
- SN is the least predictive of behavioral intentions

Perceived Behavioral Control

- Lack of hands/interactive on components to practice and experience behaviors
  - Ex: Cooking classes have increased PBC

(Steg 2009; Hanss&Bohm 2013, McDonough 2012; Levy&Auld 2004; Vermeira&Verbeke 2008; Feunekes 199

Discussion: Intentions

Why was there not a change in intentions?

Attitude-behavioral intention gap: increase in attitudes without a subsequent increase in intentions. Suggests there are other factors that influence intentions

INT was correlated with both PBC and ATT

- Similar in previous studies.
- Increase in ATT scores, but not PBC scores.
  - Students' confidence in their ability eat sustainably did improve.
  - Improving intentions may not be possible unless both ATT and PBC increase

(Vermeir&Verbeke 2006; Vermeir&Verbeke 2008; Bissonette&Contento 2001; Minteer 2004; Jager 2000)

Limitations

1. Small sample sizes of intervention groups
   - Data was not normally distributed → could not use mixed models ANOVA
   - May alter interpretation of the results
2. Self selection bias of participants → already interested in sustainable eating
3. Participants were mostly female
4. Survey: need to ask about frequency of cooking meals at home, eating local, meatless meals
5. Study setting was not controlled = a large amount of variability in intervention exposure/attentions for each participant

Conclusion

Educational farmers' market kiosks and webpages with video messages can be implemented into community nutrition interventions to increase university students' attitudes towards sustainable eating

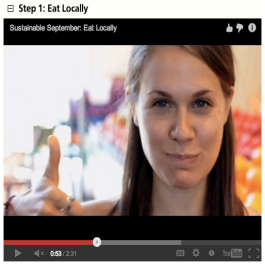
Increasing PBC will help increase intentions:

- Interactive hands on components
- Cooking classes
- Shopping lessons at the farmers' market or grocery stores

Acknowledgements

Mary Hendrickson-Nelson, MSc, RD
Hugues Plourde, PhD, RD
Amanda Unruh and Fit@McGill Team
Mary H Brown Fund
Sustainable Project Fund Grant #13
McGill Farmers' Market Team
McGill Dietetic Stagieres
McGill Bookstore and Athletic Center

Family and Friends



Appendix 5: Project Presentation – Questions and Answers

Q1: Why was participant enrollment done on a voluntary basis?

The intervention materials were designed to be used in the intervention of this study, however we also wanted to reach out to a large number of McGill students regardless of whether they were going to complete the survey or not. Using these materials on a recruited number of people in a controlled setting would have restricted exposure to other students who attend the McGill Farmers' Market.

Q2: Please give some background about the volunteers who participated in the intervention

Dietetic stagieres and myself ran the sustainable eating kiosks at the farmers' market and participated in the educational videos.

Q3: What do you mean by an increase in attitudes? Attitudes is a very complex term

We evaluated attitudes using a 5-point likert scales. For example, the question evaluating attitudes towards health benefits of eating less meat stated: "Occasionally eating meatless meals (or meals with less meat) is healthier than not doing so". If a participant chose Neutral=3 during the baseline survey, and then chose Agree=4 during the follow-up survey, this would indicate that their attitudes towards the health benefits of eating meatless meals improved. We also did this for attitudes in regards to cost, environment, convenience, and availability for all three sustainable eating behaviors.

Q4: How can social media be used in your study?

We used social media to help recruit participants and encourage students to visit the Sustainable Eating Kiosks and Webpage. Facebook messages were posted on the Fit@McGill page to advertise the intervention to students and also to post quick sustainable eating facts and tips.

Q5: Because you recruited at the market, is your sample size bias?

The sample size is likely bias because of participant self-selection, meaning that students who were already interested in nutrition and sustainable eating likely approached our booth more often. However, we used incentives such as a free gym membership, cooking at home kits, and free bookstore gift cards to encourage a variety of students to fill out the survey. We also offered free food samples to entice students to come over to the kiosk, and had the kiosk located centrally on campus (McTavish Street) where many students from all faculties will be passing through.

Q6: Was survey 2 limited to one day for participants to complete?

Survey 2 was emailed to students in November and they were given 2 weeks to complete it. At the 2-week deadline we extended the follow-up survey another week and sent out a reminder email to baseline participants to complete the survey to increase the sample number.

Q7: Explain the study correlations in further detail

For partial correlation tests between behavioral intentions and each behavioral construct score, we controlled for the other two construct scores (Ex: controlled for PBC, and SN when running the partial correlation test for ATT and Intention). In all three sustainable eating behaviors partial correlation tests demonstrated that PBC scores were significantly correlated with behavioral

intention scores to perform the sustainable behavior. ATT scores were also significantly correlated with behavioral intention scores for Cooking at Home, and Eating Meatless Meals. This means that as we see an increase in ATT and PBC scores, we will also see a corresponding increase in intention scores. Therefore, the higher the ATT and PBC scores, the higher the expected behavioral intention scores.

Q8: Did the survey address food shopping/stores and their proximity to home? Did you address barriers?

The survey did not ask students about the proximity of their homes to grocery stores or farmers' markets. Our intervention was designed with information to educate students about where they can purchase sustainable foods, and how they can purchase seasonal sustainable foods year round and at their closest grocery stores. The location of their housing is not something that we would be able to change and therefore did not address it on the survey. Background research in the literature review identified convenience and cost as two of the main barriers to eating healthy and sustainable foods in students. Therefore the intervention material was designed to demonstrate to students that sustainable and healthy eating does not have to be inconvenient or expensive. We provided tips such as "cook meals in large batches and freeze them, or use leftovers for school lunches", "visit the McGill Farmers' market on your way home from school to purchase local produce", " visit Midnight Kitchen or Happy Bellies on campus for free and low costing vegetarian meals", and "Have access to quick and simple recipes on the Sustainable Eating Webpage". We also addressed cost by comparing the price of plant based protein to meat protein, and indicated to students that cooking meals at home, opposed to purchasing meals at restaurants will help to reduce food expenses.

Q9: What methods were used to increase consumption of meatless meals in students?

At the farmers' market, all food demonstrations used vegetarian recipes. We highlighted the use of beans, lentils, and legumes as an alternative source of protein and stated their health benefits and their price comparison with meat products. We indicated to students that designating one day to eating meatless (ex: Meatless Mondays), or replacing half of their meat serving with plant based protein are convenient ways they can eat sustainably.

Q10: How would you improve the intervention to have more desirable outcomes?

The main limitation of the study was the small sample size of the intervention groups that inhibited us from evaluating which intervention group was more efficacious, and many of the behavioral construct scores did increase but did not reach significance level. Having a larger sample size would have improved the validity of the results, however recruitment was difficult (especially at the end of the study). Having a shorter survey would have helped improve recruitment, or not distributing the follow-up survey during the exam period may have also helped. To increase participation in the study it is likely that we need to increase student interest in the topic of sustainable eating. This presents a challenge, but may be done through having frequent information sessions, perhaps in first year residence before students move into their own apartments and become responsible for cooking. Also providing more hands on experiences within the intervention such as cooking classes or trips to Jean Talon Market might help to increase interest.

Q11: Did you measure quality of fruit and vegetable intake? (Juice vs. whole fruit)

To measure fruit and vegetable intake, we provided examples of daily servings. For fruit this included: 1 medium apple, ½ cup of canned frozen, or fresh fruit, ½ cup juice, ¼ cup of dried

fruit. For vegetables this included: 1 cup of raw greens, ½ cup of fresh, frozen, or canned vegetables, or vegetable juice. We did not ask if juice was 100% pure fruit juice, or from concentrate. This is something that should be clarified in future studies.

Q12: Why did more women than men meet the guidelines for fruit and vegetable intake?

It is likely that this occurred because more women participated in the study than men, and therefore this group did not accurately represent the population of male students. The main message from the fruit and vegetable intake results was that the majority of students are not consuming enough fruit and vegetables.

Appendix 6: Literature Review for NUTR 651

MCGILL

The Use of Nutrition Interventions and the Theory of Planned Behaviour to Promote Sustainable Eating

Literature Review

Claire Chartrand, 260488662

Table of Contents

1. Introduction to the food system

The global population is rising at an alarming rate. Over the past half century it has risen to 6 billion people and it is predicted to reach 9 billion by 2050 (Defra 2009). As the population continues to increase, there will also be an increasing demand on the earth to provide natural resources and food. It is predicted that agriculture is already consuming 35% of the earth's total land surface and 70% of the earth's fresh water to produce food for the ever growing population (Defra 2009). Industrial agriculture has resulted in the clearance of forests and natural habitats, the pollution of water resources, and large emissions of greenhouse gas and pollution making it one of the largest environmental threats (Foley 2011), and it is estimated that the global food system accounts for 31% of the human-caused global warming effect (Lappe 2010). To guarantee the globe's long-term health while meeting the demands of a growing population it is essential that we find ways to "obtain more for less". This means producing more food with less input from water, energy, and land resources to conserve them for future generations (Buttriss 2010). In order to prevent environmental harm from our food systems we must ask; "why does our food system result in harm to the environment? How can we change our food system and agricultural methods to become more environmentally friendly? And what can consumers do in order to be part of the solution?" (Lappe 2010)

The modern food system can be described as "taking raw natural materials and transforming them into food and nutrients that are then consumed and result in a variety of health outcomes" (Sobal, Khan et al. 1998). The food system is composed of four different levels consisting of (1) food production, (2) food processing (transforming, packaging, labeling, etc.), (3) distribution to food outlets and consumers, and (4) consumption of food at the consumer level

(American Dietitic Assocation 2007), and at each level there is input from human and natural resources.

At the level of production, large scale farms aim to meet the demands of growing populations who want access to a variety of convenient and low costing foods (Jarosz 2008). Industrial farms use unsustainable agricultural methods during food production. Practices such as the use of pesticides, fertilizers, heavy equipment, tilling, intensive irrigation, excessive packaging and processing, and food distribution over long distances are depleting natural resources and damaging the environment(Turley and Thompson 2010). More calories in fossil fuel are now used in the production of food compared to the amount of calories the food actually provides to consumers (Geagan 2009), resulting in the depletion of energy, water, soil, forests, comprised air quality, generation of excess waste, and harm to our own health (American Dietitic Assocation 2007; Brannon 2008).

Sustainability is defined as "being able to maintain over long periods of time while meeting the needs of the present population and without compromising the ability of future generations to meet their needs"(Herremans IM and Reid RE 2002) (Brundtland 1987). Sustainability revolves around three pillars. It provides (1) environmental stability, (2) economic stability, and (3) social equalities, meaning the fair treatment of workers and animals (United Nations Assembly 2005). In order for the food system to meet the demands of the present and future population, it is important that both agriculture and human dietary patterns become more sustainable. The goals of sustainable farming include the production of safe and nutritious food that contributes to human well being, farm income that can support farmers with a good quality of life, food production that meets global demands, productivity of land and soil that can be

maintained, protecting natural resources and reducing environmental damage, and ensuring social and economic equity (Buttriss 2010)

The consumers' role in global food sustainability is to participate in sustainable dietary behaviors, meaning to choose foods that are good for human health and produced using sustainable agriculture methods that do not harm the environment (Herrin M and JD 1989). Changing our diets by making more sustainable food choices could play a role in preserving the future of the environment as we make food choices several times a day. If the majority of these choices are unsustainable then the planet, our bodies, and future generations will suffer the consequences and will ultimately result in the depletion of energy and resources that are required to produce food (Pimentel, Hepperly et al. 2005). Sustainable food does not contribute to pollution, global warming, or destruction of natural resources during its course through the food system, it supports the humane treatment of both humans and animals, it is healthy for our bodies, it connects people to the land, and contributes to local economies and provides social benefits (Cheng 2007; Sustain 2007). Sustainable eating takes the consumers social responsibility into account, as well as their needs for taste, nutrition, price, and convenience (Vermeira and Verbekeb 2008).

As industrialization increases, there are also noticeable changes in lifestyle including dietary patterns and physical activity. Food availability has widely expanded and due to increasing technology and unique processing and packaging methods, consumers have access to a variety of food products outside of the typical fruit and vegetable produce, dairy products, meat and alternatives, and whole grains. There are increasing imports and exports moving food products between countries as well as increased technology allowing for the production of many different processed foods. As a result of this, we see diets shifting away from whole natural

foods and towards highly processed and packaged convenient foods that are often high in sugar, fat, salt, and preservatives. These food choices coupled with lack of physical activity can increase the risk of a variety of negative health consequences, cause strain on healthcare systems, and do not promote environmental sustainability (Dymytrenko 2009)

The world's food industry is one of the largest contributors to environmental destruction and therefore it is essential that both agricultural practices and dietary behaviors become more sustainable. Dietetic Associations, healthcare agencies, and environmental protection groups worldwide need to educate the general public on how they can make sustainable food choices, and it is important that sustainable eating practices and successful dietary intervention methods are identified to make this possible. The purpose of this literature review is to explore the concept of sustainable eating, methods on how sustainable eating can be achieved, and how sustainable eating can result in desirable health outcomes. It will focus on the dietary habits of university students and their knowledge and participation in sustainable eating. It will also examine what influences dietary behaviors and food choices, and how these behaviors can be changed to become more sustainable using the theory of planned behavior and educational nutrition interventions. The overall objective of this review is to determine the most effective way to design a sustainable eating nutrition intervention in order to change the dietary habits of university students.

2. Sustainable Eating

Sustainable eating means to make food choices that support the health of the planet, health and well-being, local economies, and the fair treatment of workers and animals. With mass consumerism and increasing urbanization in developed countries, it has lead to frequent

consumption of store bought foods that are highly processed, contained in packaging, and travelled long distances to reach consumers, all of which create an unsustainable food system (Pearson et al 2010). Because the current lifestyle in developed countries is fast paced, many consumers have become unaware of where their food comes from, how it is produced, and what kind of impact it has on their health and the environment (Kriflik and Yeatman, 2005). Past research has demonstrated that people have the desire to do the right thing and eat foods that are environmentally friendly; however, many of them lack the knowledge and understandings of what eating sustainably actually entails (Bhaskaran et al 2006), and have difficulty identifying environmentally friendly food products (Picket-Baker and Ozaki, 2008). Pearson et al 2010 researched university student's (n=30) awareness, understanding, and perceptions of sustainable food through the use of focus group discussions. Researchers asked the students two main questions: (1) "What comes to mind when someone asks you what a sustainable diet is?" and (2) "How could you make your own diet more sustainable?" Students provided a wide range of responses to what a sustainable diet means, with some saying, "it offers personal benefits such as losing weight or how long a specific diet lasted". When links were made between diet and the environment, some students said, "the term is not clear, it is very broad, and they do not fully understand what defines a sustainable diet". Students in this focus group did express that in order to make their diets more sustainable it is important to consume more fruits and vegetables, reduce food waste, and purchase local and organic foods. However, they lacked knowledge about the importance of consuming less meat products, reducing energy used in cooking and food purchasing, purchasing fish from sustainable sources, purchasing seasonal foods, and using re-usable drinking bottles (Pearson et al 2010). Results from this study demonstrate that students display a level of confusion surrounding the term "sustainable eating" and are unaware of some

of the steps they can take to achieve a sustainable diet. In order to fix this issue, people need to be made aware of what sustainable food actually means, how they can make sustainable food choices, and how they can overcome barriers that may prevent them from doing so such as geographical access, financial constraints, and limited cooking and food purchasing skills. As consumers make an abundance of food choices everyday, having the knowledge and skills to make sustainable food choices may increase sustainable dietary behaviors and therefore preserve natural resources for future generations to meet their own needs. Some ways that consumers can make their dietary behaviors more sustainable include eating locally, eating less meat, cooking at home, and reducing food waste and packaging.

2.1. Cooking at Home

By preparing more meals at home we get to choose the location where our food is purchased, have control over cooking methods and added ingredients used in preparation, and can control how much food is wasted. In order to be able to cook meals at home one must learn food skills, which are defined as "a complex, inter-related, person-centered, set of skills that are necessary to provide and prepare safe, nutritious, and culturally acceptable meals for all members of one's household" (Vanderkooy 2010). According to Vanderkooy, food skills include: (1) knowledge about nutrition, labeling, food safety and ingredient substitution; (2) planning including meal preparation and using a budget; (3) conceptualizing food including how to use leftovers and adjusting recipes; (4) mechanical techniques including chopping, mixing and cooking; and (5) food preparation including using your senses, texture, taste (Vanderkooy 2010). Due to the emergence of technologies for food storage, preparation, and cooking; and increased demands for fast and convenient meals due to shifting of family priorities and values, time, and financial demands over the last decade, there has been an emergence of processed and pre-packaged

convenient foods in Canadian homes, meaning there is decreased opportunity to acquire and maintain cooking skills (Chenhall 2011). The effect this change in lifestyle and dietary habits has in students and young adults is of particular interest because cooking skills are often learned at a young age from the transference of skills through family members. Limited exposure to cooking skills within families due to higher reliance on convenient foods (Engler-Stringer 2009) and purchasing food from restaurants (Larson et al 2011) poses as a threat to the transference of cooking skills to younger generations (Lang T and Caraher M 2001; Lyon P, Colquhoun A et al. 2003).

Purchasing and consuming meals from restaurant establishments instead of cooking meals at home is an increasing trend in developed countries and it is estimated that approximately 50% of the money spent on food in the United States was on restaurant meals (American Dietitic Assocation 2007). Eating away from the home is a global problem, and between the short time of 1995 and 2000 the number of fast food restaurants increased by 20% in Morocco, 40% in Thailand, and 120% in China (Lappe 2010). A report from Consumer Food Trends 2020 has identified the top consumer food trends which included: "increased disconnect between consumers and food preparation resulting in increased selection of portable foods and snacking", and "consumers are purchasing more meals from restaurant establishments, relying more on take out and less on traditional preparation of meals" (Serecon Management Consulting Inc 2005).

In young adults, these trends are supported by the fact that currently, those aged 20-29 consume approximately 40% of their daily energy intake outside of the home (Food Surveys Research Group, NHANES 2010). Therefore, if meals are purchased from restaurants or cafeterias, these establishments can have a large impact on dietary intake and quality. Larson et al examined how frequently a group of young adults (n=2,287) ate at different types of

restaurants, and how this affects their dietary intake and weight status. Data was collected using the Project Eat-III survey and a food frequency questionnaire. Results found that this group of young adults purchased food from a restaurant very frequently, with an average of 3-4 times per week. 88% of young adults reported eating fast food at least one or more times per week from a fast food restaurant, and 30% reported consuming food at least one time per week from a full service restaurant. When looking at dietary intake, researchers controlled for sociodemographic factors and results demonstrated that those who consume fast food more frequently had lower intakes of fruit and vegetables, fiber, whole grains, and milk products; a greater intake of total energy, total fat, saturated fat, and sodium; and a higher prevalence of overweight/obese status. However, the use of full service restaurants and sandwich shops were unrelated to body weight. Results highlight that young adults are frequently purchasing foods from fast food restaurants and demonstrate how this dietary behavior is negatively impacting the dietary quality and risk for developing nutrition related diseases such as obesity in young adults (Larson et al 2011). Ultimately, this indicates the need to develop interventions to revert students back to traditional food preparation methods such as cooking from scratch in order to improve dietary intake and health status.

As young adults are frequently purchasing prepared meals (Larson 2011), and are not required to use cooking skills in order to consume meals, this will likely affect their ability to acquire cooking skills, reduce their confidence in food preparation, and limit their food choice; forcing them to continue relying on restaurants and processed foods as a source of nutrition. Recent studies researched the current level of cooking skills in young adults, and looked to see how the current food trends such as frequent eating at restaurants and purchasing pre-prepared meals have directly shaped their dietary practices and cooking skills (Enlger-Stringer 2009;

Larson et al 2006). Engler-Stringer hypothesized that the cooking skills of young, low income populations would be especially affected by the increasing availability of processed and pre-prepared foods because lower quality food items are often offered at a lower price, and therefore are more accessible. She examined the daily cooking practices of a group of young, low-income women from the Montreal area (n=22) using 5 focus groups to discuss food preferences, cooking skills and barriers, and grocery shopping practices to develop an understanding of how food environments influenced cooking skills. During the focus groups, participants reported meal planning as complex, and that it was important to them to purchase inexpensive foods. They expressed the desire to eat healthy foods, but many of them reported it is challenging because healthy foods are more expensive and processed foods are more affordable. Due to busy schedules, they preferred meals that were easy to prepare such as Hamburger Helper™, hot dogs, and pre-packaged pasta. Some of the participants stated 'there is no point in cooking from scratch when they don't need to', and they preferred foods with instructions on the box because they were less likely to make a mistake during preparation, and therefore avoid wasting food and money. Although participants expressed desire to prepare and try new foods, they were not confident in the ability of their cooking skills to prepare them. One participant said "if a dish requires a recipe then I do not consider it easy to prepare". Results from this study demonstrate that even when consuming meals at home, many young adults are relying heavily on convenient processed foods as a source of nutrition that require few cooking skills during preparation (Engler-Stringer 2009). Participants in these study groups highlighted that convenience, low cost, and lack of cooking skills are the main driving forces for choosing processed ready to eat foods, and as barriers to preparing healthy meals. These findings were supported by another study from Larson et al 2006 which analyzed food preparation behaviors, cooking skills, and resources for

preparing food in young adults aged 18-23 years old (n=1,709). Researchers looked at how the cooking skills and level of involvement in food preparation was associated with diet quality in these young adults. Participants filled out a survey that asked them questions about their food preparation activities, cooking skills, fast food consumption, and demographics. Results from this study found that a low number of students reported buying fresh vegetables once a week (33% of females and of females and 21% of males), and 23% of females and 13% of males reported writing a grocery list. Similar to the barriers stated by the young women in Enlger-Stringer 2009 study, time and convenience was reported as the largest barrier to cooking (33% of students), followed by the cost of food (25% of students), and then inadequate cooking skills (23% of males and 18% of females). The frequency of food preparation was not associated with socioeconomic status, student status, or weight. The key finding of this study was that young adults who reported higher food preparation skills consumed fast food less often and reported better dietary quality (Larson NI, Perry CL et al. 2006). Results from both studies demonstrate there is a culinary transition occurring in the types of skills required to eat food in the current population of young adults. They are taking little part in traditional food preparation methods, and relying less on cooking skills to prepare meals. Instead, this population is purchasing more pre-prepared processed foods and eating at fast food restaurants more frequently, which is resulting in reduced dietary quality. This may increase the risk for the demise of cooking skills in current and future generations, as they are no longer required to eat. Therefore, it is important that nutrition educators address the main barriers to cooking at home with healthy ingredients such as cost, convenience, and lack of cooking skills, which were reported by participants in both studies. It is important to find successful interventions that improve the cooking skills of young adults and their ability to prepare meals at home using fresh, healthy, and sustainable ingredients.

Finding ways to improve the cooking sills of young adults is essential because previous research has demonstrated that young adults are frequently consuming prepared foods, and are lacking cooking skills; all of which have been associated with poor dietary quality (Engler-Stringler 2009; Larson et al 2006; Larson et al 2011). Levy and Auld investigated whether a cooking intervention in university students (n=65) from Colorado State University could improve knowledge and attitudes toward cooking, improve cooking skills and confidence, and increase the number of home cooked meals prepared by students. Students were divided into two groups, with both consisting of comparable baseline food knowledge and cooking skills. The first group observed cooking demonstrations that were one hour in duration accompanied by a brief lecture about basic cooking skills, and participants also sampled the meals. The second group attended four, one hour cooking classes and also attended a 45-minute supermarket tour to learn how to purchase groceries. Both groups were provided with printed educational materials as well consisting of simple and affordable recipes and information sheets that addressed knife skills, cooking supplies and equipment, and shopping tips. Participants completed a 3-day food record, an eating habits survey, a cooking survey, and a food preparation survey at baseline, 1 months, 2 months, and 3 months after the intervention (completing multiple surveys also tried to control for recall bias). Results from this study found improvements in both groups in attitudes and cooking at home behaviors. In the post test survey, all participants increased their scores for how much they believe cooking helps them to eat healthy, how much they like to cook, and how confident they are with their cooking skills. Participants also reported they ate at restaurants less often and ate more servings of fruit and vegetables. Another positive finding was that participants reported frequently sharing the information and recipes they learned during the study to others. Although the group that went to cooking classes experienced more significant

improvements in areas such as “liking to cook”, “seeing the benefits of cooking”, and “confidence using various cooking techniques”, the use of cooking demonstrations is advantageous because it can reach larger audiences, require less resources, and is less costly (Levy and Auld 2004). The findings of this study support the value of providing cooking courses to young adults and university students that focus on affordable, easy and healthy meals. This study demonstrates to nutrition educators that the use of cooking interventions and food demonstrations, along with the provision of recipes, and information on cooking skills and shopping tips, may be an appropriate method to improve attitudes towards cooking at home and make students more willing to cook healthy foods instead picking up grab and go meals or eating at restaurants.

In conclusion, research has demonstrated that young adults and students frequently purchase meals from restaurants, rely heavily on pre-prepared and processed foods when eating at home, and many of them report a lack of cooking skills; all of which are associated with poor dietary quality (Engler-Stringer 2012; Larson et al 2011, Larson et al 2006). In order to prevent the demise of traditional cooking skills it is important that successful cooking skill interventions be implemented in this population and all other age groups. Successful intervention paths will differ based on age group, previous education, and socioeconomic status. Cooking workshops and food demonstrations coupled with the provision of simple recipes, shopping tips, and cooking skills, have been effective in increasing confidence in cooking skills and the number of meals students prepare at home and may serve as an appropriate intervention pathway (Levy and Auld 2004). They offer a hands on or visual learning experience in order to establish self efficacy and promote involvement in the preparation process while addressing barriers to cooking at home and providing skills to overcome these barriers. Time constraints, convenience, and costs were

commonly identified as barriers to cooking at home (Engler-Stringer 2012; Larson et al 2006), so it is important to focus meal preparation classes and demonstration on recipes that are quick and economical, and teach cooking skills that improve students' efficiency to prepare meals. Interventions should also include a self assessment on eating patterns and behaviors to allow for participant reflection (Chenhall 2011). Re-establishing the importance of being able to prepare meals at home using traditional skills in current generation of young adults is very important, because if these generations continue to rely on prepared foods, they will not have cooking skills to pass on to the next generation. Therefore, populations will continue to rely more heavily on processed foods as a source of nutrition which are produced using industrial unsustainable techniques, have poor dietary quality, and will ultimately lead to reduced health status (Larson et al 2006; Larson et al 2011).

2.2. Eating Less Meat and More Plant Based Protein

Overproduction of livestock is resulting in serious negative consequences to the environment. The amount of energy, water, and land/soil devoted to the production of meat protein sources is significantly higher than the amount of natural resources devoted to the production of plant based protein sources (Pimentel and Pimentel 2003). In order to produce 1 calorie of animal protein it requires an average input of 25 calories of fossil fuel (ratio of 25:1), while producing 1 calorie of plant based protein only requires 2.2 calories of energy input (ratio of 2.2:1). Beef and lamb require the largest input of fossil fuel averaging an input of 40 calories of fossil fuel to produce 1 calorie of beef (ratio of 40:1), and an input of 57 calories of fossil fuel to produce 1 kcal of lamb (ration of 57:1) (Pimentel and Pimentel 2003). Agriculture including livestock production accounts for the largest consumption of fresh water in North America using as much as 85% of all fresh water (Pimentel D, Houser J et al. 1997). For example, a total of 200,000 liters of water

is used to produce 1 kg of fresh beef, and on average 100 times more water is required to produce 1 kg of animal protein when compared to plant based protein. Water is used directly by livestock; however the majority is used to produce grain for livestock feed, as today there are few livestock that consume pasture and most of them are fed diets of primarily of soybeans and corn (Thomas GW 1987; Pimentel D and M. 1996). Overproduction of livestock is also creating concern for land resources and soil conservation. Every inch of topsoil lost takes 500 years to replace and due to feed production in the United States, soil is being eroded at an alarming rate; 13 times greater than the sustainable rate of 1 ton/day (Pimentel D and . 1998).

It is predicted that the global consumption of meat will increase significantly over the next 50 years due to the increasing global population, rising incomes, and urbanization (Latvala, Niva et al. 2012). Fiala predicted that global meat consumption would increase 72% between 2000 and 2030, and Steinfeld predicted meat consumption would double by the 2050 (Steinfeld, Gerber et al. 2006; Fiala 2008). High meat production and consumption is seen in countries across the globe. A recent report on food choices in China stated that the country is now eating twice as much meat as the United States and over the past 30 years the demand for meat products has quadrupled. It is estimated that China is now consuming a quarter of the world's meat supply (71 million tons per year) and this will ultimately lead to a food crisis (Moore 2012). In a review on meat consumption trends in the United States, FAO data found that meat consumption in 2003 was approximately 325 g/d, while the US Department of Agriculture found that daily meat consumption was 250g/d in 2007 (Daniel et al 2010). According to Canada's food guide, adult women require two servings of meat and alternatives, while adult men require three. Examples of one serving of meat and alternatives include 75g of meat, poultry, or fish, 2 eggs, ¾ cup of beans, legumes or tofu, ¼ cup of nuts and seeds, or 2 tbsp. of peanut butter (Health Canada

2008). Therefore, if North Americans are consuming meat at 250-325g/day they are already consuming 3.5 – 4.5 servings of meat and alternatives from animal products alone, which is above Canada's Food Guide recommendations, and excessive consumption is a health risk (American Dietetic Association 2009).

Reducing the amount of meat present in one's diet can offer a variety of nutritional health benefits along with being environmentally protective. The American Dietetic Association has stated that well planned vegetarian diets are "healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases" (American Dietetic Association 2009). Research indicates that eating a variety of plant based protein and plant foods can provide all essential amino acids, and therefore supplementary protein is not required (Young VR and Pellett PL 1994). Vegetarian diets tend to be lower in saturated fat and cholesterol and higher in fiber, magnesium and potassium, vitamin C and E, folate, carotenoids, and other phytochemicals. Therefore eating well balanced meatless meals can result in lower levels of blood cholesterol and blood pressure, decreased risk of heart disease, diabetes, and stroke, and decreased risk of all forms of cancer (American Dietetic Association 2009).

In order to design interventions and programs to increase consumption of meatless meals in university students, it is important to understand how students currently perceive the importance of consuming meatless meals, how accepting individuals are to consuming more meatless meals, and what barriers may be preventing them from doing so. A study by Latvala et al explored the ways meat consumption patterns were changing in Finland over the past three years by using an online questionnaire that asked participants (n=1623) about their meat consumption patterns and attitudes toward meat such as healthiness, safety, price, taste preference, and environmental and animal welfare. From the questionnaire, researchers

concluded that 48% of the study population had no change in meat consumption and did not intend to reduce their intake; 12.9% of participants indicated they had reduced their meat intake over the past 3 years; and 40% of the population reported they were in the middle of an ongoing change (increasing their fruit and vegetable intake, reducing their beef and pork intake). Healthiness of meat and weight management was the most stated reasons for intending to decrease meat consumption (Latvala, Niva et al. 2012). A study by Salonen and Helne, assessed the attitudes of universities students (n=210) towards how important and feasible they considered vegetarian diets, whether they favored vegetarian meals, and what barriers prevented them from eating vegetarian meals. The survey used in this study asked participants to indicate their perceived importance, feasibility, and actual implementation of 36 aspects of sustainable development using a scale of 1-9, and mean scores for each sustainable variable were calculated and compared. Results found that vegetarian diets were ranked the as the 'least important' in relation to the all of the other sustainable behaviors, but the reported score for 'feasibility of vegetarian diets' was reported rather high. This indicates that students would find it relatively easy to eat more vegetarian meals given they thought it was more important. Students indicated the two factors that most highly influenced their consumption of meat were (1) habits, reporting "not liking the taste of vegetables and loving the taste of meat"; and (2) social groups, reporting "it is hard to change their dietary habits when friends, spouses, and family are eating meat and do not want to change". Other obstacles to adopting a vegetarian diet were availability, allergies, inconvenience and poor quality of fruit and vegetables. Students said, "they would like to eat more meatless meals but they know they would never be able to become vegetarians". (Salonen and Helne 2012). Results from the Latvala et al 2012 study, and the Salonen and Helne 2012 study indicate that people may not be aware of the importance of eating less meat and the

beneficial effects it can have on the environment. Because knowledge is a key factor in behavior change, using educational interventions to teach university students and other populations about the importance of eating meatless meals for personal and environmental health may be a way to promote behaviors towards making more vegetarian choices. Addressing some of the barriers to eating meatless meals listed by participants in the Salonen and Helne study by teaching students where to purchase good tasting vegetarian meals, fruits, and vegetables in their community, and how they can cook convenient vegetarian snacks and meals maybe also be a method of reducing meat consumption. Also, highlighting the health benefits balanced vegetarian meals can provide may be a way of catching consumers' attention and encouraging them to try more meatless meals as participants in the Latvala et al study stated that health was the most influential reason for decreasing meat intake.

As previous studies have found that people find the idea of reducing meat intake more realistic and feasible than becoming a vegetarian (Salonen and Helne 2012), or are in an ongoing change to reduce their daily meat intake (Latvala et al 2012), it is important that universities provide vegetarian meal options promote programs that encourage occasional consumption of meatless meals. A campaign called "Meatless Mondays", associated with the John Hopkins' Bloomberg School of Public Health, designates one day per week when meatless meals are consumed in order to reduce meat intake by 15% in order to reduce their carbon footprint and protect their health (Meatless Monday 2013). Advertising Meatless Mondays on campus and having campus cafeterias provide an abundance of vegetarian meals once per week may be a more realistic method of encouraging consumption of meatless meals amongst university students.

Incorporating meatless meals into university cafeterias may be a way to decrease meat consumption and provides a way to expose students to a variety of vegetarian dishes that they can enjoy, and may inspire them to cook more meatless meals at home. However, doing this may pose as a challenge. Students from the Salonen 2012 study reported loving the taste of meat (Salonen 2012), and meat is considered a standard ingredient in many North American meals and university students may not readily accept meatless meals. Roch 2012, and Eckhart et al 2010 examined the acceptability of meatless meals. Roch 2012 determined how the overall acceptability of a vegetarian meal, garden burgers, compares to the acceptability of regular beef burgers by university students (n=39) consisting of 3 vegetarians. The majority of students had never tried the garden burger, but most non-vegetarians consumed beef burgers at least monthly. When taste testing was done, students were more likely to rate the sensory qualities and acceptance of the garden burger higher than the scores of the beef burger, a result that indicates including this menu option more frequently in cafeterias does have some promise to reduce meat consumption. Although this study only looks at one specific vegetarian food item, and future studies should include a variety of vegetarian dishes, this study demonstrates that it is possible for students to enjoy vegetarian meals (Roche 2012). A similar study by Eckhart et al in 2010 examined how willing a racial mix of students from an elementary and middle school were to purchase vegan meals from their school cafeterias. During the 4-week intervention, the schools provided 3 to 4 main dishes for students to choose from during lunchtime, and once a week there was a low fat vegan option including a veggie burger, vegetarian chili, and rice and beans. Results demonstrated that over the four days vegan meal options were available, their sales represented 61-91% of lunch entrées sold, depending on which option was available and these meal options also did not increase the burden for kitchen staff. A weakness within both of these

studies was that they were brief, and although students like the taste sample of the garden burger, or were willing to purchase vegan meals when occasionally offered, both studies do not address whether this willingness would be sustained over a longer period of time. Therefore, providing more vegetarian options in school cafeteria can be a healthy alternative to typical cafeteria food, while decreasing meat consumption and promoting sustainable dietary behaviors (Eckhart 2010).

In conclusion, consumers in developed countries are consuming meat at levels higher than the recommended intake (Daniel at al 2012). Reducing meat consumption is essential in a sustainable diet to reduce GHG emissions, preserve natural resources, and prevent environmental damage along with reducing the risk of various chronic diseases (Pimintel and Pimentel 2003; American Dietetic Association 2009). Previous research suggests many consumers do not find eating less meat important, they enjoy the taste of meat, and find it consuming meat is convenient (Salonen and Helne 2012). However, those eating less meat said health concerns was one of the main influences for reducing meat intake (Latvala et al 2012). Therefore, in order to develop successful interventions to reduce meat intake, nutrition educators should (1) provide consumers with facts about the environmental and health consequences excessive meat production can cause in order to improve their knowledge and attitudes; (2) provide consumers with vegetarian recipes that taste good and are simple to make; and (3) highlight the health benefits of consuming less meat. School foodservices should also be addressed in order to increase the number and variety of vegetarian dishes in place of meals containing meat. Advertising vegetarian meals as something other than “a substitute meat” is an idea that might help increase acceptance of vegetarian meals, and may encourage students to try a new dish. Also, adopting programs such as Meatless Monday in cafeterias allow for health promotion

opportunities across campuses, and are a great way to advertise to students how they can make small sustainable changes in their diet.

2.3. Eating Locally

Food trade has become more prevalent over the past hundred years, and over a thirty-year span between 1968 and 1998 food production increased by 84% and world food trade increased by 184%. The United Nations predicts transport emissions could continue to grow up to 70% by the year 2020 (U.N Environmental Program ; Lappe 2010). Pirog et al looked at food distribution systems and compared food transportation distances of fruits and vegetables between local, regional, and conventional farms in Iowa. Researchers hypothesized that carbon dioxide output would be reduced if food were only distributed using local and regional systems (farms within Iowa). Local systems were defined as farmers who sell and market their produce directly through community supported agriculture outlets such as farmers' markets, local restaurants or cafeterias, hospitals, etc., and most of the time food is delivered using small delivery trucks. Results from this study found that the conventional system used 4 to 17 times more fuel and 5 to 17 times more CO_2 than the Iowa based regional and local systems. Also, growing 10% more of the produce consumed by Iowa citizens in Iowa each year could reduce CO_2 emissions from the state by 6.7 to 7.9 million pounds annually (Pirog 2001). A supporting study found that imported foods produced forty-five times more greenhouse-gas emissions than local foods, and if these foods travelled by plane they produced up to five hundred time more emissions, illustrating the environmental benefits of purchasing foods grown closer to your home (Natural Resource Defence Council 2007).

Several suggestions for consumers to reduce the food miles travelled by their food and help protect the environment include: buying locally grown food whenever possible from community supported agriculture food outlets; growing your own fruits and vegetables or participating in community gardens; making grocery lists and plan weekly meals in order to minimize trips to the grocery store, and consulting with dietitians to learn about how to incorporate fresh foods into recipes and your daily meals (Pirog et al 2001). Other suggestions for consumers include purchasing seasonal fruits and vegetables from local markets, and canning locally purchased fruits and vegetables so they are accessible in winter months.

Farmers' Markets are defined as "retail outlets in which two or more vendors sell agricultural products directly to customers through a common marketing channel" (Jilcott, Keysrling et al. 2011). Farmers' markets differ from other food outlets by three defining features. First, they provide an outlet for local farmers to sell their produce, thereby reducing food miles and reliance on imported foods. Although foreign foods are still available at many markets, most markets focus on providing a large majority of fresh, local when they are in season throughout the year (Jarosz 2008). By travelling shorter distances, energy used for transportation and bypassing middlemen in the distribution chain will be reduced. Second, many of the farmers selling food products at the market produce on small-scale farms and unlike industrial farms, it is more common for small-scale farms to produce their food using organic methods. Industrial farms contribute large inputs of chemical fertilizers and pesticides into the environment causing air and water pollution (Jarosz 2008). And third, most farmers' markets are committed to social, economic, and environmental sustainable food production, distribution, and consumption (Grey 2000; Kloppenburg Jr., Lezberg et al. 2000; La Trobe and Acott 2000). Purchasing food from farmers' markets will help support local farmers, help consumers to establish a relationship with

their food provider and trust on where their food comes from, and connect consumers to the land (Jarosz 2000; Sage 2003; Carolan 2006).

Community farmers' markets provide an accessible source of fruit and vegetables to consumers and previous studies from Rundle et al, Courtemanche, and Jilcot et al have found that communities with a larger abundance of farmers' markets have associated decreases in body mass index (BMI) and obesity prevalence. Rundle et al performed a study to examine if an association exists between neighborhood food environments and body mass index (BMI) of New York City residents (n=13,201). Unlike many previous studies linking food environment to dietary intake and obesity, researchers in this study controlled for built environment characteristics such as land-use mix, density of bus and subway stops, population density, percentage of commuters using public transit, and pedestrian travel; and also considered the food environment as a whole including all restaurants, grocery stores, and specialty vendors in the city instead of just a few types of food outlets. Researchers also controlled for race, education, and neighborhood poverty level. Each subject's neighborhood was defined as the half-mile area surrounding his or her residential address. Food outlets were grouped into one of three categories: BMI healthy (ex: stores with fruits and vegetables), BMI unhealthy (ex: bakeries), and BMI neutral. Results from this study showed a significant inverse relationship between BMI and the density of BMI healthy food outlets. The average BMI of the neighborhood with the highest density of Healthy-BMI food outlets (10.98 outlets per km^2) was 0.8 units ($p<0.01$) less than the neighborhoods with the lowest density of Healthy BMI food outlets (0.76 outlets per km^2), indicating that BMI decreases in neighborhoods that have more healthy food outlets. However, there was no relationship between the densities of BMI unhealthy or intermediate food outlets with the BMI of participants (Rundle A, Neckerman KM et al. 2009). These results were

supported by a study from Jilcott et al that examined the association of obesity prevalence and per capita farmers' markets, grocery stores, and super centers in 90 counties across the United States. Associations were measured using regression models with independent variables: per capita farmers' markets, grocery stores, and supercenters, and the dependent variable being obesity. Researchers controlled for natural amenities (access to water and climate factors), percent Black, percent Hispanic, median age and median household income. Results found that in non-metro counties, there was an inverse relationship between the number of farmers' markets and prevalence of obesity. An increase in one standard deviation for farmers' markets per 1000 residents was associated with a decrease in the obesity prevalence by 0.07%. In metro counties, there was an inverse relationship between the number of farmers' markets, grocery stores, supercenters and obesity with an increase by one standard deviation resulting in a decrease in the prevalence of obesity by 0.58% (Jilcott, Keysrling et al. 2011). Although the limitation of self-selection bias is present in all of these studies (when people decide where to live based on a certain neighborhood; for example, people with a healthy BMI may choose to live in communities with access to healthy food outlets and opportunity for physical activity); results from these studies indicate that there is an association between increasing access to farmers' markets and healthy food outlets and decreases in obesity prevalence, possibly to due to the provision of fresh and healthy produce. These studies demonstrate the importance and health benefits of having community access to healthy food stores including Farmers' Markets in order to prevent the risk of developing nutrition related diseases, along with promoting the purchase of sustainable foods.

Along with reductions in body weight and obesity, increased access to farmers' markets has also been associated with increases in fruit and vegetable intake. Evans et al 2012 examined

whether introducing small farmers' markets into a low income community in Austin would increase fruit and vegetable intake of local residents (n=100) who lived within a walk-able distance (defined as a half mile radius from the market). The farm stands were open once a week for three months and two to three farmers sold a variety of seasonal fruit and vegetables. Baseline and follow up questionnaires asked participants about their fruit and vegetable intake, how important it is for them to consume fruit and vegetables, and their awareness of farmers' markets. Results from this study found that during the baseline survey, the largest intake of fruits and vegetables was from "other vegetables" and "fruit juice". After the farmers' market was opened in the community, there were significant increases in daily consumption of whole fruits by 0.46 servings ($p<0.001$), fruit juice by 0.31 servings ($p<0.001$), tomatoes by 0.20 servings ($p=0.006$), green salad by 0.14 servings ($p=0.017$), and other vegetables by 0.23 servings ($p=0.001$). Results also found there were significant increases in: the percent of participants who reported awareness of neighborhood farmers' markets (20% increase, $p=0.001$); the percent of participants who reported purchasing fruit and vegetables from farmers' markets (18.2% increase, $p=0.004$); and in the percent of participants who perceived fruit and vegetable intake to be very important (15.7% increase, $p=0.021$) (Evans et al 2012). This low-income study population may be representative of a student population because many students do not work while at university. Overall, this study demonstrates that increasing access of farmers' markets to low-income populations may have dietary benefits and is associated with an increased intake of fruit and vegetables (Evans et al 2012).

As demonstrated by previous studies, having access to healthy food outlets and farmers' markets within communities can help to increase daily intake of fresh fruit and vegetables, reduce the prevalence of obesity, and overall improve healthy status (Evans et al 2012; Jilcott,

Keysrling et al. 2011; Rundle A, Neckerman KM et al. 2009). Accessible farmers' markets will also encourage populations to purchase more local foods, which is a sustainable dietary behavior that can help preserve the environment and natural resources, support local farmers, and help consumers establish a relationship with their food and an understanding of where it is coming from. Having healthy food outlets available and easily accessible to students such as university run farmers' markets and healthy restaurants may be a feasible method to encourage students to purchase healthy meals and fresh produce in order to increase fruit and vegetable intake and prevent nutrition related disease. Farmers' markets could also serve as a location to provide nutrition and food information, and a location for health promotion interventions. Providing educational interventions to university students about the environmental implications of local foods, locations where they can purchase local foods, how to shop for seasonal fruits and vegetables, and how to find local foods within grocery stores may help improve attitudes and beliefs towards purchasing local foods and increase students' self-efficacy to do so.

2.4. Reducing food waste and minimizing food packaging

Food waste is defined as "all the food that is produced and purchased then discarded by humans" (Gallo 1980). In developed countries where food is abundant, accessible, often inexpensive (in the case of processed foods and snacks) and "waste rather than reuse" is the norm; an increasing amount of food waste is proving to be an environmental threat (Falk 1994). It is estimated that 3.6% of total greenhouse gas emissions comes from waste (Lappe 2010). Food waste occurs at multiple levels of the food system including production, processing, distribution, preparation, and consumption (Sobal 1999). Waste from food production can occur from natural disasters, insect damage, overproduction, or failure to harvest all food. Food processing can result in spillage or damage to products and food handling mistakes. Improper

packaging and storage can cause damage to food in the distribution phase. And at preparation and consumption at the consumer level, edible portions of food might be removed, leftovers are not used wisely, portion sizes are served to large, and bulk purchases might result in food expiring before it is used (Kantor, Lipton et al. 1997; Griffin, Sobal et al. 2009). On average developed countries produce enough food for each individual within their population to consume 3,309 calories per day which is higher than the majority of the population actually requires (Smith et al). These excess calories will either never reach our plates or are consumed leading to expanding waistlines and health consequences such as cardiovascular disease, diabetes, high blood pressure and cholesterol, metabolic syndrome, etc.

In 1997, approximately 96 billion pounds of food waste (one quarter of all food produced) was produced in the United States throughout the entire food system (Kantor, Lipton et al. 1997). In Canada, 27 billion dollars of food waste was reported in 2010 and 50% of this occurred in consumer homes.(Macdonald 2009). The most common foods wasted in homes includes fruit and vegetables, fresh meat, and dairy products and it is predicted that 80% of food thrown away was edible at some point (Gooch, Felfel et al. 2010). Providing education about reducing food waste throughout all levels of the food system is important. Intervention strategies targeting consumers is especially important because this group is the largest contributor to food waste. Consumers could be educated about how to efficiently purchase, store, and prepare foods and how to effectively use leftovers.

Ultimately, consumers can make their diets more sustainable by purchase fresh natural foods from local sources, cooking healthy meals at home and minimizing consumptions of processed foods, eating less meat, and reducing food waste and packaging. In order to change these behaviors it is important to determine what factors influence food choice and what

behavior change theories are most effective in changing behavior, and then use these factors and theories within nutritional interventions.

3. Determinants of food choice and the theory of planned behavior

3.1. Determinants of dietary behaviors and food choice

Food selection and eating behavior are complex processes that come into play at each meal. When selecting and consuming food one must consider what to eat, how much to eat, where and when to eat their meal, and with whom to eat with. In order to fully understand food choices and how researchers can influence it through nutrition interventions, it is important to understand the driving factors behind the choice to select healthy or un-healthy foods (Dymytrenko 2009). Some factors that influence food choice include:

- *Taste preference:* A study examined 141 students in grades 7 and 10 from a diverse racial/ethnic school district in Minnesota, examined what influenced their food choice and behaviors through the use of focus groups and completion of a 24-hour food recall. Taste preference, described as food cravings and the appeal of food was indicated as one of the primary determinants of food choice in adolescents and adults. When asked what would make them eat more healthful foods, participants responded that improving the taste and appearance of foods as the first suggestion. (Neumark-Sztainer, Story et al. 1999). Lappalainen et al also found that taste was one of the five most listed influences on food choice in a study in Europe (Lappalainen, Kearneyc et al. 1998), and Driskel et al found that taste was one of the top two reasons why university students purchased fast food (Driskell 2006). The results from theses studies have implications for future design

of intervention programs, indicating that if educators can teach people recipes for healthy sustainable meals that taste good, people may be more likely to choose them instead of junk foods

- *Perceived benefits*: the study by Neumark-Sztainer also found that the "perceived benefits" of a food had an influence on food choice, as stated by many participants. These perceived benefits included a source of energy, influence on body shape and condition, kept participants full for longer, and were healthy and helped improve sports performance (Neumark-Sztainer, Story et al. 1999).
- *Self efficacy:* Larson et al 2006 reported that young adults who reported more frequent food preparation skills used fast food less often reported better dietary quality, indicating that healthy food choices are found to be more frequent in those who believe they are capable of choosing, preparing, and cooking healthy foods (Larson NI, Perry CL et al. 2006).
- *Cost of food:* the cost of food may be more influential on low economic status individuals and young adults including university students (Lappalainen, Kearneyc et al. 1998; French, Story et al. 1999). Lappalainen et al examined attitudes towards food, nutrition, and health of 14,331 subjects from member states of the European Union. The questionnaires to assess healthy eating were done by in house face-to-face interviews of residents in each European country and asked each participant to rank the benefits of healthy eating and to assess factors that influenced food choice (price of food, quality and freshness, taste, etc.). Results of this study found that price was in the top five listed influences of food choice in all countries, along with quality and freshness, taste, trying to eat healthy, and family preferences. Researchers recommended that nutrition educators

design interventions that help people to learn how to make healthy food choices that do not involve high expenses. (Lappalainen, Kearneyc et al. 1998)

- *Convenience*: the ease of purchase, food preparation and cooking time and cleanup after a meal may play a role in determining food choice. Consuming whole foods usually requires some preparation while picking up fast food or frozen dinners is considered convenient. Driskell et al performed a study to determine the fast food restaurant habits of 226 college students, including influences on why they chose fast food. Results found 71% of the 226 respondents stated the main reason they chose to consume fast food was that it was convenient when they were time limited; a result that is supported by findings from other studies (Enlger-Stringer 2009; Larson et al 2006). Taste was also indicated as a strong influence for purchasing fast food by 41% of the students. The strong influence of convenience on food choice in students indicates that nutrition educators need to teach people how to prepare quick and convenient healthy meals from home to decrease the consumption of processed and fast food, and improve dietary quality (Driskell, Meckna et al. 2006).
- *Peers and family related determinants:* during university, eating is an important time of socialization, recreation and relaxation and many students associate meal time with friends, pleasure, and fun. Family eating habits are also very influential on food attitudes, preferences, and values. Feunekes et al performed a study that focused on the influences of direct social environment (friends and family) on food choice in adolescents, and hypothesized that when social influences had an impact on food choice, the dietary patterns between these two social groups would be similar. Participants and their family members and close friends completed surveys consisting of food frequency

questionnaires, demographic questions, and questions about their relationships within the network. Results for resemblance in food intake found associations between husbands and wives (94%), mothers and adolescents (87%), and fathers and adolescents (76%), and adolescents and their friends (19%). Foods associated between adolescents and their friends were mostly snack foods, which agrees with previous findings that adolescents and possibly other age groups associate junk foods with friends and socializing. Results from this study illustrate how social norms influence eating behaviors within social networks (Feunekes, De Graaf et al. 1998).

Taste preference, self-efficacy, cost of food, perceived benefits, convenience, and peers and families, were factors identified as main driving influences on food choice in previous studies. When designing nutritional interventions for students, it is important to identify which factors have the highest influences and create barriers on food choice, and determining how they affect dietary behavior so they can be addressed properly within the intervention to increase its success. Marquis 2005 researched what factors influence food choice and dietary behaviors in first year university students (n=139) living in residence at the University of Montreal. The questionnaire consisted of questions related to food motivations (time, cooking skills, health motivations, etc.) as well as a food frequency questionnaire; both of which were pre-tested before being delivered to students. Results for food motivations found that convenience was the most important followed by price, pleasure and taste, and health. Students that were more concerned (higher score) with foods being convenient had higher scores for perceiving lack of time as a difficulty associated with cooking. These students also lacked food variety in their diet, had a lower intake of fruit and vegetables, and a consumed frozen and processed food more frequently. Consequences of convenience being a primary determinant of food choices include less frequent

family meals if living at home, increased snacking, and increased consumption of processed unsustainable processed foods, and loss of cooking skills. These results were supported by other studies examining cooking skills and dietary patterns of young adults (Engler-Stringer 2009; Larson et al 2006; Larson et al 2011). Nutrition educators need to teach students that healthy whole foods such as fruit and vegetable are not necessarily less convenient and can be incorporated into daily diets. For example, bringing carrot or celery sticks, or a whole apple, is quick and convenient, yet healthy and more sustainable (Marquis 2005).

In conclusion, results from past research indicate that convenience has the strongest influence on food choice in students, and was also negatively associated with cooking skills and dietary quality (Driskell, Meckna et al. 2006; Marquis 2005). Therefore, in order to change dietary behaviors to more healthful and sustainable ones, and to increase fruit and vegetable intake, nutrition educators should teach students about recipes that are simple to prepare and can be taken to school or work for lunch or snacks. For example, teaching students about how to prepare large portions of meals and properly store left-overs for future use is an idea to educate to students about how cooking at home is convenient. Another example includes educating students about what foodservices and food retail outlets are conveniently available to them on campus or around university neighborhoods that provide healthy and sustainable foods for purchase (ex: University Farmers' markets on campus). Price and taste were also main influential factors on students' food choice (Engler-Stringer 2009; Lappalainen, Kearneyc et al. 1998; Marquis 2005; Neumark-Sztainer, Story et al. 1999) indicating it is important that nutrition interventions to teach students about how too eat on a budget, provide budget friendly recipes, and teach students that healthy meals can still taste good. Examples of how cost effectiveness could be incorporated into an intervention include, highlighting the fact that plant protein sources such as legumes,

lentils, and bean are offered at a lower price than meat products to encourage students to choose vegetarian options more often. To address taste, providing students with taste samples of low cost healthy meals during food demonstrations and through cooking classes may teach students that good tasting meals do not have to be purchased from restaurants or from processed food sources, and healthy foods can taste good as well. Lastly, health and perceived benefits of food were demonstrated as a main influence on student food choice (Marquis 2005; Neumark-Sztainer, Story et al. 1999) indicating that within interventions, nutrition professionals need to highlight the health benefits of eating whole foods such as fruits and vegetables, eating less meat and more plant based protein (American Dietetic Association 2009), and cooking at home instead of purchasing meals from restaurants (Larson et al 2011; Larson et al 2006). Overall, addressing major influences to food choice such as convenience, cost, taste, and health may help nutrition educators to develop successful intervention that promote healthy and sustainable dietary behaviors.

3.2. Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is a model that is used to predict one's intention to perform a specific behavior. The model proposes that behavioral intention represents the motivation behind behavior and indicates to what extent a person will put forth effort into performing that behavior (Ajzen 1991). The theory predicts that three main driving forces determine intention: perceived behavioral control, attitudes, and subjective norms. Perceived behavioral control (PBC) refers to how capable one feels they are at successfully performing a behavior and is similar to self-efficacy (Kellar and Abraham 2005). If a student believes they possess the cooking skills making them capable of preparing and cooking vegetables then they are more likely to do so. Attitude (ATT) refers to one's overall evaluation of the behavior,

meaning that if the behavior will result in a positive outcome then that person is more likely to perform it (Ajzen 1991). If a student believes eating less meat is good for their health and better for the environment than they are more likely to do it. Finally, subjective norms (SN) refer to one's beliefs about how significant others (family, friends, peers, etc.) think they should behave. This implies that if a student's roommates believe cooking at home is healthy, then this may increase their behavioral intention to cook at home (Ajzen 1991).

Multiple studies have applied the theory of planned behavior to dietary behaviors. A study by Sparks and Shepherd examining intention to eat, and actually eating fruit and vegetables found that the TPB accounts for 42% of the variance in intention to eat organic vegetables (Sparks and Shepherd 1992). Brug et al found that the TPB accounted for 47% of the variance in intentions to eat fruit (Brug, Lechner et al. 1995). While Povey et al looked at intentions to eat 5 portions of fruit and vegetables per day found that the TPB accounted for 57.2% (Povey, Conner et al. 2000). In relation to sustainable behaviors, Bisonette and Contento found that the TPB accounted for 30.9% of the variance in intention to purchase local foods (Bisonette and Contento 2001). These studies indicate that the TPB provides a useful description of the motivational factors behind dietary behaviors.

Studies have also used the TPB to gain a better understanding of students' current attitudes towards sustainable eating. Bissonnette and Contento investigated whether ATT, SN, and personal responsibility towards diet related environmental consequences influenced the intentions and food choice of adolescents living in New York State (n=669) to purchase local and organic foods. Researchers prepared a survey derived from pilot interviews with a group of 14 adolescents that contained scale questions pertaining to each of the following psychological variables within the TPB, along with demographic questions. Results found that many of the

adolescents had poor attitudes in regards to sustainable eating practices. Only half (51.3%) of participants agreed that industrial farming practices are harmful to the environment. Although 75% of participants said organic foods were better for the environment and better for their health, only 50% of participants believed foods travelling from far away contributed to more pollution. The majority of teens said eating local (71.8%) and organic foods (80%) were not important to them, and also reported the ability to eat their favorite foods year round was more important than whether food was grown locally; indicating that a sustainable diet was not a priority. Many participants also reported they did not feel responsible for purchasing local (58%) or organic (61%) foods. (Bissonnette and Contento 2001). Results from this study indicate that adolescents were not knowledgeable and did not have supportive attitudes towards sustainable eating practices. These results emphasize that using interventions to develop opportunities for students to learn about sustainable eating is needed to improve their attitudes about sustainable eating, help them become engaged in sustainable food systems, and ultimately change their behavior.

The poor attitudes of adolescents towards sustainable dietary behaviors found in the study by Bissonnette and Contento were supported by similar findings in young adults in studies by Robinson and Smith 2002, and Pelletier et al 2013. Robinson and Smith identified and evaluated variables predictive of intention to purchase sustainable foods of 550 shoppers in Minnesota stores using the TPB. Surveys were given to shoppers to assess the three dimensions of the TPB (ATT, SN, PBC) and intended and past purchasing behavior. When looking specifically at results surrounding the attitudes of participants, results from one-way ANOVAs found that those aged 50-60 had higher attitude scores towards purchasing sustainable foods than those under the age of 30. Also, those aged 51-70 were more likely to have purchased sustainable foods in the past and had higher intention scores to purchase sustainable foods in the future than those under the

age of 30. This indicates that age might be influential of attitudes and intentions surrounding sustainable behaviors; meaning that awareness about sustainable eating may need to be raised in younger populations (Robinson and Smith 2002). Petellier et al also examined the attitudes of university students towards sustainable foods results found that 51% of students reported low importance to them that their food was sustainable. Similar to results from Bissonette and Contento, results from this study also found that older students, over the age of 25 had higher attitude scores towards sustainable eating. In regards to attitudes, results from these studies demonstrate that sustainable eating behaviors are not considered important, or a priority in young adults and adolescents. And compared older adults, young adults have significantly lower attitudes towards sustainable eating. These results indicate that this population may need more education about the link between nutrition and agriculture/food production to improve their attitudes about sustainable foods and help change their dietary behavior.

Within the model of the TPB, the attitudes of students towards sustainable foods and dietary practices will play a part in predicting their intentions and behaviors to take part in sustainable eating practices. How these attitudes affect dietary behaviors may be also affect the quality of one's diet. Pelletier et al 2013 looked specifically at how students' attitudes towards sustainable food products are associated with the quality of their diet, and researchers hypothesized that students (n=1201) with positive attitudes about consuming sustainable foods would have higher levels of fruit and vegetable intake, and lower intake of processed and sugar refined foods. Researchers used a survey that assessed the students' attitudes on sustainable foods, their dietary quality using a self report, and also asked them questions about how frequently they consume breakfast and fast food over the week, and how often over the past thirty days they have consumed regular soda, fruit drinks, sports drinks, or other sweetened beverages. When looking

at the associations of dietary quality with attitude scores, researchers used a linear regression and controlled for demographic characteristics and vegetarian status. Results found that those who reported sustainable foods more important to them had overall healthier dietary patterns and consumed 1.3 more servings of fruit and vegetables ($p<0.001$), more fiber ($p<0.001$), and lower intakes of refined sugars and sugar sweetened drinks ($p<0.001$), and less fat ($p=0.025$) and more frequently consume breakfast ($p<0.001$). Overall, the results of this study suggest that attitudes towards sustainable food may be a predictor of diet quality, and incorporating sustainability topics into nutrition interventions to enhance awareness and improve attitudes may help increase fruit and vegetable intake along with decrease consumption of processed and sugar refined foods (Pelletier et al 2013).

According to the Theory of Planned Behavior (TPB), intentions to perform a specific behavior are influenced by attitudes (ATT), social norms (SN), and perceived behavioral control (PBC). Understanding which of these behavioral constructs is most influential on and predictive of sustainable behavioral intentions is important in order determine how nutrition interventions can be constructed to properly address these constructs to change dietary behaviors. In a study by Vermeira and Verbekeb, researchers aimed to gain a better understanding of sustainable purchasing behavior in students (n=456) aged 19-22 by looking at the predictive values of attitude, perceived behavioral control, and social norms in explaining consumer intention to purchase sustainable dairy products. The survey consisted of questions assessing ATT, SN, and PBC using a seven-line scale, and included an informative advertisement for a hypothetical sustainable dairy product (to rule out influence from brand) and information about sustainable production methods and consequences. When average scores for each behavioral construct were calculated, results found that most respondents did not experience high SN as a factor that

influences their intention to purchase sustainable products, but had higher mean scores for PBC and ATT, indicating that these constructs may be more influential on consumer intentions to purchase sustainable food. Attitudes had the highest positive correlation with behavioral intentions, meaning that as ATT increased there was also an increase in intentions to purchase sustainable foods. Using a multiple regression analysis, the TPB model explained 50.1% of the variance in intentions (Vermeira and Verbekeb 2008). Because the study used a hypothetical sustainable food product, this may have impacted students' PBC scores because they had not seen it available in any grocery stores; making PBC have less of an impact on behavioral intentions. Results from the Vermeira and Verbekeb study were supported by findings from other studies as well. In adolescents, ATT explained the largest proportion of the variance in intention to purchase local and organic foods, and therefore was the greatest predictor of these dietary behaviors (Bissonnette and Contento 2001). And Robinson and Smith 2002 also reported that ATT was the most predictive of intentions to purchase sustainable foods in a sample of grocery shoppers (Robinson and Smith 2002). Overall results from these studies indicate that attitudes are the most influential on intention to purchase sustainable foods, followed by PBC, and SN does not seem to significantly influence behavioral intentions. Therefore, targeting ATT and PBC constructs in interventions to promote sustainable eating may be the most effective method in changing consumer intentions and behaviors to take part in sustainable dietary behaviors (Vermeira and Verbekeb 2008).

In order to use the TPB in interventions to change dietary behaviors and increase sustainable food choices, it is important that techniques are identified for use within each behavioral construct (ATT, SN, PBC). Techniques within each construct of the TPB used to change dietary behaviors using the three constructs include (Abraham, Kok et al. 2010):

1. Attitudes: providing general health information about the benefits and health links of eating a certain food and provide materials about the consequences, and providing information about dietary impacts on the environment (Ex: how eating beef can result in large consumptions of natural resources). This will help to establish a relationship between the dietary behavior and positive or negative health and environment outcomes that can result if this behavior is performed.
2. Subjective norms: information about others' approval and behaviors in sustainable and health contexts can be provided along with social comparisons. By doing so one can be informed about what others are doing and how they are eating.
3. Perceived behavioral control: instructional and material resources can be provided such as recipes and cooking methods, places to purchase local foods, etc. Telling people how to perform behaviors and arguing against self-doubt will increase individual confidence to perform a dietary behavior.

In conclusion, teens, university students, and young adults in particular have demonstrated less desirable attitudes and poor intentions to eat sustainably (Bissonnette and Contento 2001; Robinson and Smith 2002). Research has demonstrated that students with more positive attitudes about sustainable food are consuming higher quality foods, which can help prevent chronic disease (Petellier et al 2013). Therefore, it is important that young adults are educated about the environment and health benefits of consuming sustainable foods in order to improve their attitudes. In order to change these unhealthy and unsustainable dietary behaviors we can use the theory of planned behavior and provide education and resources at all three psychological construct levels (attitudes, social norms, and perceived behavioral control) to increase their intentions to eat sustainably. Because ATT and PBC are constructs demonstrated

to be more influential on behavioral intentions (Vermeira and Verbekeb 2008), it is important that both constructs are well addressed within nutrition interventions. This includes the provision of information about sustainable food systems and its implications on the environment to improve knowledge, awareness, and attitudes of students. As well as the provision of hands on experiential learning, take home messages, and "sustainable eating tips" to improve students' self-efficacy to actually perform sustainable dietary behaviors.

4. Educational Nutrition Interventions Targeting University Students and Changing Dietary Behavior

It is important that good nutritional habits are established at a young age so they can be carried on throughout one's lifetime. Adolescents, university students, and young adults are developing a personal identity, beliefs, morals, and values (Cobb 1992). As young adults begin university they start to separate from the influence of their parents, become more independent, and are more responsible for their food choices. Many students explore their new freedom by consuming more unhealthy snack foods and fast food as they begin to adjust to their new lifestyle (Demnison and Shepherd 1995). Papadaki et al studied the change in dietary habits of university students who remained living with their parents versus university students who lived on their own using a food practice questionnaire. Results found that the eating habits of students living at home remained the same while those who lived on their own experienced changes in their diet such as decreased intake of fruit and vegetables and fish, and increased their intake of sugar, alcohol, and fast food. Findings from this research suggest that the dietary habits of students are affected as they begin to take responsibility for their own food choices (Papadaki, Hondros et al. 2007). Targeting university students with nutritional interventions to promote

sustainable and healthy eating is important because they are just beginning to define their individual dietary habits and many struggle with making the right choices.

College students are often unfamiliar with the term "sustainable eating" and are not informed about how their diet can affect not only their own health, but also the long-term health of the planet (Pearson et al 2010). In order to increase students' consumption of healthy and sustainable foods it is important to construct interventions that provide personal and global health messages in a variety of different communication channels (Turley and Thompson 2010). Although there is a wide variety of nutrition information available to the public, a difficult challenge is determining the most effective way to deliver this information so it is viewed as important, understood, remembered, and can be applied to everyday life. Delivery of messages that are translated into simple terms, set in the context of everyday life, consistent, repeated over time and presented to the audience in a way that captures their attention are the most successful in the public health service. When developing nutritional messages it is important to consider the age, life stage, gender, education, income, and mental and physical ability of the target audience. Previous materials that were educationally effective have used familiar words and avoided jargon or slang, included take home messages, used pictures to demonstrate ideas, and gave practical information such as stepwise tips or a recipe (Buttriss 2011).

Nutritional messages can be delivered to the general public using many different channels of communication including: pamphlets, commercials, magazines, websites, pictures and diagrams, posters, and videos. Rayner looked at a large variety of interventions trying to increase fruit and vegetable intake and found that only 11% of these interventions were successful in doing so (Rayner 1998). It was proposed that many of the interventions were unsuccessful in changing dietary behaviors because they assumed that just providing the educational material would be

effective and did not take into consideration that attitudes, self efficacy, social norms and intentions towards health behaviors also need to be changed. Educational materials and interventions need to be able to capture the attention and engage their viewers in order to be deemed important, understood, and applied (Cox, Anderson et al. 1998).

When designing nutritional interventions for university students it is important to remember that this generation is referred to as the "Web 2.0 generation" and using technology is highly incorporated into their everyday lives. The Internet is a great tool that can spread information efficiently to a large audience in a way that is cost effective, and it provides many opportunities to be used in the healthcare industry. YouTube, a video sharing site, allows educators to construct creative and engaging teaching techniques, and also provides an accessible and affordable channel to communicate information to a variety of participants including health and nutrition (Burke and Snyder 2008). Using YouTube as an educational tool can: (1) provide a variety of video materials on multiple topics, (2) provide an efficient and affordable means of distributing information to people in a way that can relate, (3) offer real life examples and video demonstrations of topics and concepts, and (4) aid in translating scientific information into a form that the general public can apply to their everyday lives (Burke, Snyder et al. 2009).

Many studies have researched the effectiveness of using new media approaches to enhance nutrition knowledge and improve dietary intake. Some of these approaches include the use of Internet and webpages, educational videos, and even video games. Silk et al 2008 examined the effectiveness of three different mediums (a pamphlet, webpage, and video game) to disseminate nutrition information to females ages 18-50 (n=155). Researchers hypothesized that interventions that are educational, yet interactive and entertaining would prove more efficient for subjects in increasing and retaining nutrition knowledge. Participants were randomly assigned to one of the

three study groups and spent 20-30 minutes exposed to their assigned intervention. Participants were asked questions about likability, intention to use nutrition information, nutrition knowledge, and demographics at baseline and following the intervention 10-12 days later. Using a one-way ANOVA for analysis of data between groups, researchers found that those in website and pamphlet groups learned significantly more about nutrition than the video game group. And those in the website group but not the pamphlet group had significantly more knowledge about *My Pyramid* and food servings than the video game group. Not only was the website intervention more successful in increasing nutrition knowledge, it was also had significantly higher average ratings for 'liking' when compare to the pamphlet and video game, had significantly higher ratings for 'attention' and 'intention to use' when compared to the pamphlet, and had significantly higher ratings for understanding when compared to the video group (Silk, Sherry et al. 2008). Results from this study indicate that the Internet and webpages can be effective communication channel to deliver nutrition information and increase knowledge, and is also enjoyable to use.

Along with webpages, the usefulness of other new media communications such as video messages, have also been evaluated to see if they are effective in proving nutrition education and changing behaviors. Jackson et al examined the efficacy of a video doctor to teach pregnant woman about nutrition and health related topics during their pregnancy (Jackson, Stotland et al. 2011); while Nichols and Schmidt evaluated the impact of video tapes and printed recipe tips placed in grocery stores in educating shoppers about fat and cholesterol and providing nutrition information (Nichols and Schmidt 1995). Both studies hypothesized that an interactive multimedia approach would be more successful of capturing the attention of their audience, enhancing understanding, and changing eating behaviors. In the Jackson et al study, pregnant

women were randomized into two groups, the treatment (n=134) or control (n=153). The treatment group viewed a video including a doctor (played by an actor) using motivational techniques to deliver individualized counseling messages in nutrition, exercise, and weight gain during pregnancy and the control group proceeded to receive the clinic's usual care. Participants were assessed four weeks later using the same questions from the baseline survey. After the intervention, only the video doctor group displayed a significant increase in exercise minutes, intake of fruit and vegetables, whole grains, avocados, fish, and nuts, and a significant decrease in sweets, white grains, high fat meats, and fried and fast foods. The total number of knowledge questions answered correctly about nutrition, exercise, and weight gain during pregnancy was significantly higher in the video doctor group than the control group (Jackson, Stotland et al. 2011). In the study by Nichols and Schmidt, researchers placed educational brochures, recipes, and played healthy eating videos on repeat that were practical, motivating, and eye catching in four grocery stores, for 3 months in the Idaho County. Residents of the county were contacted before the intervention to fill out the pre-survey (n=620) and then after the intervention (n=827). Participants completed a nutrition knowledge test both times, and during the follow up stated wither they saw the videos, how many, and which ones. Using a one-way ANOVA, results from this study found that those who watched the videos had significantly higher scores on the nutrition knowledge quiz scores than those who did not watch them, Those who watched at least three videos had the highest nutrition knowledge scores, and whether or not the consumer filled out the pre-test had no effect on knowledge scores (Nichols and Schmidt 1995). Results from both studies indicate that providing nutritional messages in the form of short videos could be successful in increasing nutrition knowledge and influencing dietary behaviors and food purchases. Once video messages are produced, they can be easily distributed to the general

public, and could reduce burden on public healthcare agencies. Because video messages and webpages have both demonstrated success in improving nutrition knowledge (Jackson, Stotland et al. 2011; Nichols and Schmidt 1995; Silk, Sherry, et al. 2008), combining both communication channels in future nutrition interventions may create an intervention even more successful at teaching the public about nutrition and health.

The use of webpages, videos, and printed materials have been effective in improving knowledge in a variety of nutrition topics such as 'nutrition and health during pregnancy', 'dietary fat and cholesterol', and 'nutrition literacy' (Jackson, Stotland et al. 2011; Nichols and Schmidt 1995; Silk, Sherry, et al. 2008). Determining what kind of interventions have been used in the past to promote sustainable dietary behaviors, evaluating the success of these interventions, and developing ways to make them more effective in the future is important in order to be able to create an intervention to promote sustainable dietary behaviors in university students. Studies with interventions using online resources have been used to promote sustainable dietary behaviors past; however results about the success in changing behaviors have been conflicting (Eastman 2012; Hanss and Bohm 2013). Eastman 2012 used the transtheoretical model of behavior change, which is similar to the TPB, to design a three-week, online intervention for college students (n=191) in order to try and increase the sustainability of their dietary habits and improve their attitudes towards sustainable eating. The baseline survey defined sustainable eating for students as " Eating locally grown foods, produce that is in season, limited intake of processed foods, consuming food and beverages labeled organic and fair trade and fair trade certified, eating meatless meals weekly, and selecting meat, poultry, and dairy that do not contain hormones or antibiotics." The pre and post surveys evaluated the demographic variables, intake of fruits and vegetables, students' stage of change to "eat green", how

frequently the students participated in green behaviors, the students beliefs and attitudes about sustainable eating, and how confident the student were in their ability to eat green. The intervention consisted of four online educational modules that were emailed to students: Introduction to Green Eating, Eating with Ethics, Eating Locally, and Eating Meatless Meals. Students accessed the modules using a computer; each one took less than five minutes, and each model provided take home messages and goals, and links to other websites with more information if students wished to view it. Between modules, students also received weekly "Green Bytes" to their email which were motivational messages based on their answer to "the stage of change" question in the pre surveys. Results from this intervention found there was no difference in green eating behaviors or attitudes, or change in reported 'stage of change' from baseline to follow up. There was a slight increase in self-efficacy to eat green during the follow up survey but nothing that reached significance. Overall, results indicate that this intervention was not successful at moving participants to higher levels of the stages of change model, and did not improve green eating scores or self efficacy. Possible explanations include the short period of time for study, and having a similar trial lasting for more weeks may have to improve its effectiveness. Also, the intervention did not get strong motivational ratings. For improvements that could be made in future studies, the most common suggestions made included the provision of recipes, more links to videos, and making it more interactive. Including these features in future interventions may help improve sustainable dietary eating behaviors (Eastman 2012).

Another study, by Hanss and Bohm 2013 designed an online informational intervention strategy to increase intentions to purchase, and actual purchases of sustainable groceries, and to increase sustainable development self-efficacy beliefs of participants aged 18-70 years old (n=145). Participants were divided into a control and intervention group, and the intervention

was comprised of four steps. Step one informed the participants about major environmental problems and their consequences in order to increase their awareness. Step two demonstrated how human activities are the major cause of these problems in order to help consumers gain greater confidence in humanity's ability to cause, fix and prevent these problems. Step three informed participants about how to make sustainable dietary choices that would help fix problems identified in step one. And step four addressed self-efficacy beliefs by encouraging participants to make sustainable choices and addressed social norms by providing examples about how the participants' behaviors, and behaviors of those around them can encourage others to adopt sustainable dietary habits. Participants completed a pre, post, and follow up survey (6 months after the intervention) that assessed their purchasing behavior, purchasing intentions, and self-efficacy. Results found that the intervention group had significant increases in intentions and actual purchases of sustainable groceries immediately, and 6 months after the intervention that was not experienced in the control group. However, there were no changes in self-efficacy beliefs. Researchers hypothesize that this change in intentions and purchasing behaviors was due to increased knowledge and awareness about sustainability due to the information provided in the intervention steps, however they did not measure participants' knowledge in the surveys so this cannot be concluded. From this study, it can be concluded that informational campaigns can serve as effective information for improving sustainable dietary behaviors even if they do not improve self-efficacy beliefs (Hanss and Bohm 2013)

Results from the Eastman 2012 and Hanss and Bohm 2012 study show conflicting results about the efficacy of internet interventions to improve sustainable eating behaviors. Although results from Hanss and Bohm demonstrated an online informational intervention could increase intentions and behaviors to purchase sustainable foods, Eastman found it was not effective in

improving ‘green eating’ behaviors. Results may not have been found in the Eastman study because modules were very brief and intended to be completed within five minutes. Therefore, unlike Hanss and Bohm who built a foundation of knowledge in regards to sustainable consumption and its consequences, Eastman may have only been able to provide more brief messages that may not have been successful changing participants’ attitudes and increasing their knowledge on green eating subjects. Another explanation for the difference in these findings might be in the overall ‘liking’ of the intervention, the ability of the intervention to be viewed as ‘meaningful’, or the ability of the intervention to convey the information to the participants. In the Eastman study program satisfaction surveys indicated that 52% of students said the program moderately motivated them, and 25% said it only slightly motivated them, 31% said overall the program it was satisfactory, while 18% said it needed improvement (Eastman 2012). These responses show that the study was not necessarily motivating or was well liked by the participants and may contribute to insignificant changes in green eating behaviors between pre and post survey scores. Although participant satisfaction was not directly measured in the Hanss and Bohm study, how well the information was conveyed to participants was measured and findings suggested that the information reached the participants, they found it inspiring, and thought they could contribute directly to sustainable consumption. This reinforced that providing a foundation of information to participants might be the best way to capture the attention of the audience, increase their knowledge, attitudes, intentions, and behaviors to take part in dietary behaviors.

In conclusion, it is important for nutrition educators to create innovative techniques that are motivating to present nutritional information, especially when designing nutritional interventions for university students due to their reliance on the Internet and technology. Results from past

studies indicate that the use of brief video messages, informational webpages, and printed material could be successful communication channels in increasing nutrition knowledge, attitudes, and positively influencing dietary behaviors (Eastman 2012; Hanss and Bohm 2013; Jackson, Stotland et al. 2011; Nichols and Schmidt 1995; Silk, Sherry et al. 2008). There are some limitations to using video and Internet sources to educate the public. Unlike face-to-face educational modules between participants and educators, participants are unable to converse, ask questions, or receive feedback about nutrition information and dietary behaviors from educators. However, there are also many benefits to using "edu-tainment" approaches in the future including its ability to reach large audiences, cost effectiveness, availability for the public to repeatedly refer back to for reference, and it may improve audience attention (Silk, Sherry et al. 2008)

5. Conclusion

In summary, it can be concluded that there is an urgent need to educate the public, about sustainable eating and the effects it can have on the environment and health. Young adults and students especially have demonstrated less intentions and positive attitudes towards sustainable eating. To increase intentions and behaviors to eat sustainably it is important that steps in sustainable eating such as (1) eating local, (2) reducing meat intake while consuming more plant based protein, (3) cooking at home, and (4) reducing food waste and packaging are demonstrated to the public in well thought of interventions using creative and innovative teaching techniques. Construction of these interventions can use the theory of planned behavior to change behavioral intentions to eat sustainably and healthy. Interventions especially need to address attitudes and perceived behavioral control towards sustainable eating practices, while targeting driving forces behind food choices and barriers to healthy eating including cost, convenient, cooking skills, and

taste. In order to be successful, nutritional messages need to be kept simple and motivating, portraying health and environmental benefits to making sustainable food choices. Interventions and messages must also provide instruction, tips, and materials to enhance self-efficacy for sustainable food purchasing, preparation, and consumption.

References

Abraham, C., G. Kok, et al. (2010). Health Promotion. The international association of applied psychology handbook of applied psychology, Oxford Wiley-Blackwell.

Ajzen, I. (1991). " The theory of planned behavior." Organizational Behavior and Human Decision Processes **50**(2): 179-211.

American Dietetic Association (2009). "Position of the American Dietetic Association: Vegetarian Diets." Journal of the American Dietetic Association **109**: 1266-1282.

American Dietitic Assocation (2007). "Position of the American Dietetic Association: Food and Nutrition Professionals Can Implement Practices to Conserve Natural Resources and Support Ecological Sustainability." J Am Diet Assoc. **107**: 1033-1043.

Bissonnette, M. and I. Contento (2001). "Adolescents' Perspectives and Food Choice Behaviors in Terms of the Environmental Impacts of Food Production Practices: Application of a Psychosocial Model." Journal of Nutrition Education **33**(2): 72-82.

Brannon, C. A. (2008). "Organics: separating science fiction from fact." Today's Dietitian **10**(4): 8-14.

Brug, J., L. Lechner, et al. (1995). "Psychosocial determinants of fruit and vegetable consumption." Appetite **25**(3): 285-296.

Brundtland, G. (1987). Our Common Future. New York, NY, Oxford University Press.

Burke, S. and S. Snyder (2008). "YouTube: An Innovative Learning Resource for College Health Education Courses." International Electronic Journal of Health Education **11**: 39-46.

Burke, S., S. Snyder, et al. (2009). "An Assessment of the Faculty Usage of YouTube as a Teaching Resource." The Internet Journal of Allied Health Science and Practice **7**(1).

Buttriss, J. (2010). "Nine billion mouths to feed by 2050: the challenge of establishing a sustainable food supply." Nutrition Bulletin **35**: 219-225.

Buttriss, J. (2011). "Getting balanced nutrition messages across Translating complex science into life-course health promoting strategies." Proceedings of the Nutrition Society **70**: 38-46.

Caraher M, Dixon P, et al. (1999). "The state of cooking in England: the relationship of cooking skills to food choice." British Food Journal **101**(8): 590-609.

Carels, R. A., J. Harper, et al. (2006). "Qualitative perceptions and caloric estimations of healthy and unhealthy foods by behavioral weight loss participants." Appetite **46**(199-206).

Carels, R. A., K. Konrad, et al. (2007). "Individual differences in food perceptions and calorie estimation: an examination of dieting status, weight, and gender." Appetite **49**(450-458).

Carolan, M. S. (2006). " Social change and the adoption and adaptation of knowledge claims: whose truth do you trust in regard to sustainable agriculture? ." Agriculture and Human Values **23**: 325-339.

Cheng, M. (2007). "New Approaches for Creating the Therapeutic Alliance: Solution-Focused Interviewing, Motivational Interviewing, and the Medication Interest Model." Psychiatr Clin N Am **30**: 157-166.

Chenhall, C. (2011). Impproving Cooking and Food Preparation Skills. A synthesis of evidence to inform program and policy development. H. Canada.

Cobb, N. (1992). Adolescence: continuity, change and diversity. Mayfield, CA, Mountain View.

Courtemanche C and C. A. (2010). "Supersizing supercenters? The impact of Wal-Mart Supercenters on body mass index and obesity."

Cox, D. N., A. S. Anderson, et al. (1998). "Take five, a nutrition education intervention to increase fruit and vegetable intakes: Impact on consumer choice and nutrient intakes." British Journal of Nutrition **80**(2): 123-131.

D., P. (1980). Handbook of energy utilization in agriculture. Raton, FL, CRC Press.

Daniel, C., et al. (2010). "Trends in Meat Consumption in the USE." Public Health Nutrition **14**(4): 575-583.

Defra. (2009). "Department of Environment, Food and Rural Affairs: First report from the Council of Food Policy Advisers. Sept 2009.", from www.defra.gov.uk/foodfarm/food/policy/council/pdf/.

Demnison, C. M. and R. Shepherd (1995). "Adolescent food choice: an application of the Theory of Planned Behaviour." Journal of human Nutrition and Dietetics **8**: 9-23.

Driskell, J. A., B. R. Meckna, et al. (2006). "Differences exist in the eating habits of university men and women at fast-food restaurants." Nutrition Research **26**(10): 524-530.

Dymytrenko, M. (2009). Determinants and Correlates of Junk Food Consumption among Students of the National University of "Kyiv-Mohyla Academy", National University of "Kyiv-Mohyla Academy" School of Public Health.

Eastman, K. and G. Greene (2012). The "Green Eating" Project: A Pilot Intervention to Promote Sustainable and Healthy Eating in College Students, University of Rhode Island

Engler-Stringer R (2009). "The Domestic foodscapes of young low-income women in Montreal: Cooking practices in the context of an increasingly processed food supply." Health Education and Behaviour

Evans, A., R. Jennings, et al. (2012). "Introduction of farm stands in low-income communities increases fruit and vegetable among community residents." Health and Place **18**: 1137-1143.

Falk, P. (1994). The Consuming Body. Sage, CA, Thousand Oaks.

Feunekes, G., C. De Graaf, et al. (1998). "Food choice and fat intake of adolescents and adults: Associations of intakes within social networks." Preventitive Medicine **27**(645-656).

Fiala, N. (2008). "Meeting the demand: An estimation of potential future greenhouse gas emissions from meat production." Ecological Economics **67**(412-419).

Foley, J. (2011). "Can We Feed the World and Sustain the Planet?" Scientific American: 60-65.

Food Surveys Research Group. Table 9. Away from home: Percentages of selected nutrients contributed by foods eaten away from home, by gender and age, in the United States, 2009-2010. *What We Eat in America*, NHANES, 2010; http://www.ars.usda.gov/ Services/docs.htm?docid□18349. Accessed March 3, 2013.

French, S., M. Story, et al. (1999). "Cognitive and demographic correlates of low fat vending snack choices among adolescents and adults." Journal of the American Dietetic Association **99**(471-475).

Gallo, A. E. (1980). " Consumer food waste in the United States." National Food Review 3 **12**(13-16).

Geagan, K. (2009). Go Green Get Lean: Trim your waistline with the ultimate low carbon footprint diet. New York, NY, Rodale Books.

Gooch, M., A. Felfel, et al. (2010) "Food Waste in Canada." Value Chain Management Centre.

Grey, M. A., . (2000). " The industrial food stream and its alternatives in the United States: an introduction." Human Organization **2**: 143-150.

Griffin, M., J. Sobal, et al. (2009). "An analysis of a community food waste stream." Agriculture Human Values **26**: 67-81.

Hanss, D. and G. Bohm (2013). "Promoting purchases of sustainable groceries: an intervention study." Journal of Environmental Psychology **33**(53-67).
Health Canada (2008). "Food and Nutrition: What is a Food Guide Serving of Meat and Alternatives?". Retrieved March 5, 2013, from http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/choose-choix/meat-viande/serving-portion-eng.php.
Herremans IM and Reid RE (2002). "Developing awareness of the sustainability concept." J Env Educ **34**: 16-20.
Herrin M and G. JD (1989). "Designing a sustainable regional diet." Journal of Nutrition Education and Behaviour **21**: 270-275.
Jackson, R., N. Stotland, et al. (2011). "Improving diet and exercise in pregnancy with Video Doctor counseling: A randomized trial." Patient and Education Counseling **83**: 203-209.
Jarosz, L. (2000). "Understanding agri-food networks as social relations." Agriculture and Human Values **17**(3): 279-283.
Jarosz, L. (2008). "The city in the country: Growing alternative food networks in Metropolitan areas." Journal of Rural Studies **24**: 231-244.
Jilcott, S., T. Keysrling, et al. (2011). "Examining Associations among Obesity and Per Capita Farmers' Markets, Grocery Stores/Supermarkets, and Supercenters in US Counties." Journal of American Dietetic Association **111**: 567-572.
Kantor, L., K. Lipton, et al. (1997). "Estimating and addressing America's food losses." Food Review **20**(1): 2-12.
Kellar, I. and C. Abraham (2005). "Randomized controlled trial of a brief research-based intervention promoting fruit and vegetable consumption." British Journal of Psychiatry **10**: 543-558.
Kloppenburg Jr., J., S. Lezberg, et al. (2000). "Tasting food, tasting sustainability: Defining the attributes of an alternative food system with competent, ordinary people." Human Organization 177-186.
Kriflik, L. S. and H. Yeatman (2005). "Food scares and sustainability: A consumer perspective." Health, Risk & Society **7**(1): 11-24
La Trobe, H. L. and T. G. Acott (2000). "Localising the global food system." International Journal of Sustainable Development and World Ecology **7**: 309-320.
Lang T and Caraher M (2001). "Is there a culinary skills transition? Data and debate from the UK about changes in cooking culture." Journal of the Australian Institute of Home Economics **8**(2): 2-14.
Lappalainen, R., J. Kearneyc, et al. (1998). "A Pan EU survey of consumer attitudes to food, nutrition and nealth: an overview." Food Quality and Preference **9**(6): 467-478.
Lappe, A. (2010). Diet For a Hot Planet. New York, Bloomsbury.
Larson NI, Perry CL, et al. (2006). "Food preparation by young adults is associated with better diet quality." Journal of the American Dietetic Association **106**(12): 2001-2007.
Larson, N., et al. (2011). "Young Adults and Eating Away from the Home: Associations with Dietary Intake Patterns and Weight Status Differ by Choice of Restaruant." Journal of the American Dietetic Association **111**: 1696-1703.
Latvala, T., M. Niva, et al. (2012). "Diversifying meat consumption patterns: Consumers' self-reported past behaviour and intentions for change." Meat Science **92**: 71-77.
Levy, J. and G. Auld (2004). "Cooking Classes Outperform Cooking Demonstrations for College Sophomores." Journal of Nutrition Education **36**: 197-203.

Lewis S (1991). "Nutrition education at the point of purchase: a comparison of video taped messages and printed information." The Reporter **47**: 24-26.
Lusk, J. L. and F. B. Norwood (2007). Some Economic Benefits and Costs of Vegetarianism. Stillwater, OK, Oklamhoma State University, Department of Economics.
Lyon P, Colquhoun A, et al. (2003). "Deskilling the domestic kitchen: national tragedy or the making of a modern myth?" Food Service Technology **3**: 167-175.
Macdonald, N. (2009). "What a waste, Macleans." from http://www2.macleans.ca/2009/11/09/what-a-waste.
Marquis, M. (2005). "Exploring convenience orientation as a food motivation for college students living in residence halls." International Journal of Consumer Studies **29**: 55-63.
Meatless Monday (2013). "Meatless Monday Campaigns." Retrieved Febuary 2013, from http://www.meatlessmonday.com/about/.
Moore, M. (2012). Meat-eating China warned it could face a food crisis. London Daily Telegraph.
Natural Resource Defence Council (2007). Food Miles: How Far Your Food Travels Has Serious Consrquences for Your Health and then Climate. Washington, DC, NRDC.
Neumark-Sztainer, D., M. Story, et al. (1999). "Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents." Journal of the American Dietetic Association **99**(929): 937.
Nichols, L. and M. Schmidt (1995). "The Impact ofVideo Tapes in Educating Grocery Store Shoppers about Fat and Cholesterol." JNE **27**: 5-10.
Papadaki, A., G. Hondros, et al. (2007). "Eating habits of University students living at, or away from home in Greece." Appetite **49**: 169-176.
Pearson, D., et al. (2010). Sustainable consumption in Australia: What do Generation Y consumers know about their food choices? Australian and New Zealand Marketing Academy (ANZMAC) Conference Christchurch New Zealand
Pelletier, J., M. Laska, et al. (2013). "Positive Attitudes toward Organic, Local, and Sustainable Foods Are Associated with Higher Dietary Quality among Young Adults." Journa of the Academy of Nutrition and Dietetics **113**: 127-132.
Pickett-Baker, J. and R. Ozaki (2008). "Pro-environmental products: marketing influence on consumer purchase decision." Journal of Consumer Marketing **25**(5): 281-293
Pimentel D and K. N. . (1998). "Ecology of soil erosion in ecosystems." Ecosystems **1**: 416-426.
Pimentel D, Houser J, et al. (1997). "Water resources: agriculture, the environment, and Society." Bioscience **47**: 97-106.
Pimentel D and P. M. (1996). Food, energy and society. Niwot, CO, Colorado University Press.
Pimentel, D., P. Hepperly, et al. (2005). "Environmental, energetic, and economic comparisons of organic and conventional farming systems." Bioscience **55**(7): 573-582.
Pimentel, D. and M. Pimentel (2003). "Sustainability of meat-based and plant-based diets and the environment." American Journal of Clinical Nutrition **78**: 660S-663S.
Povey, R., M. Conner, et al. (2000). "Application of the theory of planned behaviour to two dietary behaviours: Roles of perceived control and self-efficacy." British Journal of Health Psychology **5**(121-139).
Rayner, M. (1998). "Vegetables and fruit are good for us so why don't we eat more?" British Journal of Nutrition **80**(2): 119-120.

Robinson, R. and C. Smith (2002). "Psychosocial and Demographic Variables Associated with Consumer Intention to Purchase Sustainably Produced Foods as Defined by the Midwest Food Alliance." Journal of Nutrition Education and Behaviour **34**(316-325).

Rundle A, Neckerman KM, et al. (2009). " Neighborhood food environment and walkability predict obesity in New York City." Environment Health Perspect **117**: 442-447.

Sage, C. (2003). "Social embeddedness and relations of regard: alternative 'good food' networks in south-west Ireland." Journal of Rural Studies **19**: 47-60.

Salonen, A. and T. Helne (2012). "Vegetarian Diets: A way towards a Sustainable Society." Journal of Sustainable Development **5**(6): 10-24

Serecon Management Consulting Inc (2005). Canadian Food Trends to 2020: A Long Range Consumer Outlook. Agriculture and Agri-Food Canada. Ottawa, ON.

Silk, K. J., J. Sherry, et al. (2008). "Increasing Nutrition Literacy: Testing the Effectiveness of Print, Web site, and Game Modalities." Journal of Nutrition Education Behaviour **40**: 3-10.

Sobal, J. (1999). Food system globalization, eating transformations, and nutrition transitions. In Food in global history. Westview, CO, Boulder.

Sobal, J., L. Khan, et al. (1998). " A conceptual model of the food and nutrition system." Soc Sci Med **47**: 853-863.

Sparks, P. and R. Shepherd (1992). "Self-identity and the theory of planned behavior: Assessing the role of identification with green consumerism." Social Psychology Quarterly **55**(4): 338.

Steinfeld, H., P. Gerber, et al. (2006). "Livestock's long shadow. Environmental issues and options. Rome: Food and Agriculture Organization of the United Nations." from ftp://ftp.fao.org/docrep/-fao/010/a0701e/A0701E00.pdf (24.6.2009).

Sustain. (2007). "Eat well and save the planet! A guide for consumers on how to eat greener, healthier and more ethical food." from http://www.sustainweb.org/.

Thomas GW (1987). Water: critical and evasive resource on semi-arid lands. Jordan WR, ed. Water and water policy in world food supplies. College Station, TV, Texas A&M University Press**:** 83-90.

Turley, J. M. and J. Thompson (2010). "A New Holistic Model Portrays Health and Food Sustainability." The International Journal of Environment, Cultural, Economic and Social Sustainability **6**(1): 346-353.

U.N Environmental Program. "Climate Neutral Network." from http://www.unep.org/climateneutral/default.aspx?tabid=154.

U.S. Department of Agriculture (2006). USDA Nutrient Database for Standard Reference. Agricultural Research Service.

United Nations Assembly. (2005). "Report of the 2005 World Summit Outcome. ." from http://www.unep.org/greenroom/documents/outcome.pdf

US Department of Agriculture (2001). Agricultural Statistics. US Department of Agriculture. Washington, DC.

Vanderkooy, P. (2010). "Food skills of Waterloo Region adults." Fireside Chat Presentation available online: www.chnet-works.ca

Vermeira, I. and W. Verbekeb (2008). "Sustainable food consumption among young adults in Belgium: Theory of planned behaviour and the role of confidence and values." Ecological Economics **64**: 542-553.

World Health Organization (1996). "Micronutrient malnutrition—half of the world's population affected." Worl Health Organization **78**: 1-4.
Young VR and Pellett PL (1994). "Plant proteins in relation to human protein and amino acid nutrition." Am J Clin Nutr **59**: 1203-1212.

Appendix 7: Research Ethics Board Approval

McGill

Research Ethics Board
Faculty of Agricultural and Environmental Sciences

McGill University
Macdonald Campus
21 111 Lakeshore
Saint-Anne-de-Bellevue, QC H9X 3V9

Tel: (514) 398-8716
Fax: (514) 398-8732
www.mcgill.ca/macdonald/research/compliance/human/

Certificate of Ethical Acceptability
Research Involving Humans

REB File #: 986-0812

Project Title: *"Promoting the advantages of local and healthy eating using food demonstrations and video interventions"*

Principal Investigator: Claire Chartrand

Department: School of Dietetics and Human Nutrition

Status: Graduate Student

Supervisor: Hugues Plourde

Funding Agency and Title: n/a

This project was reviewed and approved by

Expedited Review ___✓__
Full Review _____

Elias Georges, Interim Chair
REB, Faculty of Agricultural and Environmental Sciences

Approval Period: August 27, 2012 to August 26, 2013

This project was reviewed and approved in accordance with the requirements of the McGill University Policy on the Ethical Conduct of Research Involving Human Subjects and with the Tri-Council Policy Statement: Ethical Conduct For Research Involving Humans

---

*All research involving human subjects requires review on an annual basis. A Request for Renewal form should be submitted at least one month before the above expiry date.
*If a project has been completed or terminated and ethics approval is no longer required, a Final Report form must be submitted.
*Should any modification or other unanticipated development occur before the next required review, the REB must be informed and any modification can't be initiated until approval is received.